BSS- 9800A
BSS- 9800J
BSS- 9800K

MU- 980RA
MU- 980RJ
MU- 980RK
RY- 002PA
VD- 900RA
VD- 900RK
VL- 900PA
VL- 910RA
JA- 960PA
JA- 980PA
AY- 900PA
AY- 910PA
AA- 900PA
WS- 920PA
EK- 900P
RY- 900P
QI- 920P

Life Scope S
BEDSIDE STATION

BSS-9800

0634-001414A

Model: BSS-9800A/J/K

Manual code no.: 0634-001414A

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This manual is organized.	1	2	3	4	5
I can find the information I want.	1	2	3	4	5
The information is accurate.	1	2	3	4	5
I can understand the instructions.	1	2	3	4	5
The illustrations are appropriate and helpful.	1	2	3	4	5
The manual length is appropriate.	1	2	3	4	5

Comments:

Thank you for your cooperation. We appreciate it very much.

Name:
Occupation/Position:
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Contents

EMC RELATED CAUTION i
Conventions Used in this Manual and Instrument iii
Warnings, Cautions and Notes iii
Explanations of the Symbols in this Manual and Instrument iv

Section 1 General 1C.1

Introduction 1.1
General Information on Servicing 1.2
Service Policy, Service Parts and Patient Safety Checks 1.4
Service Policy 1.4
Service Parts 1.4
Patient Safety Checks 1.5
Composition 1.6
Bedside Station Main Unit 1.6
GUI Board (Option) 1.6
Color Display Unit (Option) 1.6
Color LCD Unit (Option) 1.7
Color LCD Unit (Option) 1.7
Input Boxes (Option) 1.7
Modules (Option) 1.8
Recorder Unit (Option) 1.11
CCO Unit (Option) 1.11
Display Connection Box (Option) 1.11
Multi Gas Unit (Option) 1.11
Multigas Unit (Option) 1.12
Flash ROM Disk (Option) 1.12
Cart (Option) 1.12
Isolation Transformer (Option) 1.12
Interface (Option) 1.12
Specifications 1.13
Bedside Station Main Unit, BSS-9800A/J/K 1.13
Dimensions and Weight (Approximate) 1.13
Displays 1.13
Sound 1.14
Alarm 1.14
Central Monitor 1.14
Power Requirement 1.14
Environment 1.15
Clock Accuracy 1.15
Electromagnetic Compatibility 1.15
Safety Standard 1.15
Color Display Unit, VD-900RA/RK (Bedside Monitor) (Discontinued) 1.16
Color Display Unit, VD-900RA/RK (Central Monitor) (Discontinued) 1.16
Color LCD Unit, VL-900PA (Bedside Monitor) 1.16

Color LCD Unit, VL-900PA (Central Monitor) 1.17
Color LCD Unit, VL-910RA (Bedside Monitor) 1.17
Color LCD Unit, VL-910RA (Central Monitor) 1.17
Trendgraph 1.17
Full Disclosure 1.18
Input Box, JA-960PA 1.18
Input box, JA-980PA 1.18
Multi Parameter Module, AY-900PA 1.18
ECG 1.18
Respiration (Transthoracic impedance pneumography) 1.20
SpO_2 and Pulse Wave (Arterial Plethysmographic Waveform) 1.20
Non-invasive Blood Pressure, NIBP 1.20
Multi Amplifiers 1.21
Invasive Blood Pressure, IBP 1.21
Temperature 1.22
Cardiac Output, CO 1.22
Respiration (Thermistor probe pneumography) 1.23
Inspired Oxygen Fractional Concentration, FiO_2 ..... 1.23
Expired Carbon Dioxide Tension, CO_2 ..... 1.24
ECG/BP Output 1.24
Multi Parameter Module, AY-910PA 1.25
SpO_2 and Pulse Wave (Arterial Plethysmographic Waveform) 1.25
Recorder Module WS-920PA and Recorder Unit WS-921RA/RJ/RK 1.25
BIS Module, AE-900PA 1.25
EEG Module, AE-910PA 1.26
FLOW/Paw Module, AF-900PA 1.26
$S\bar{v}O_2$ Module, AL-910PA 1.26
CO_2 Module, AG-900PA 1.27
Multi Gas Unit, AG-910RA/RK 1.27
Multigas Unit, AG-920RA/RK 1.29
CCO Unit, AH-900RA/RJ/RK 1.30
Interface, QI-910RA/RJ/RK 1.30
Names and Function of Parts 1.32
Control Panel 1.32
Remote Control 1.33
Color Display Unit 1.34
Front Panel 1.34
Rear Panel 1.34
Color LCD Unit (VL-900PA) 1.35
Front panel 1.35
Right Side Panel 1.35
Color LCD Unit (VL-910RA) 1.36
Front panel 1.36
Right Side Panel 1.36
Main Unit 1.37
Front Panel 1.37
Side Panel 1.37
Rear Panel 1.38
Input Box 1.39

Front Panel 1.39
Rear Panel 1.39
Input Box 1.40
Front Panel 1.40
Left Side Panel 1.40
Right Side Panel 1.40
Multi Parameter Module 1.41
Smart Module 1.43
Recorder Module 1.44
BIS Module 1.44
EEG Module 1.45
FLOW/Paw Module 1.45
$S\bar{v}O_2$ Module 1.46
CO_2 Module 1.46
Multi Gas Unit (AG-910RA/RK) 1.47
Front Panel 1.47
Rear Panel 1.47
Multigas Unit (AG-920RA/RK) 1.48
Front Panel 1.48
Rear Panel 1.48
CCO Unit 1.49
Front Panel 1.49
Rear Panel 1.49
Recorder Unit 1.50
Front Panel 1.50
Rear Panel 1.50
Display Connection Box 1.51
Front Panel 1.51
Rear Panel 1.51
Interface 1.52
Front Panel 1.52
Rear Panel 1.52
Block Diagram 1.53
MU-980RA/RJ/RK Main Unit 1.53
VD-900RA/RK Color Display Unit 1.54
VL-900PA Color LCD Unit 1.55
VL-910RA Color LCD Unit 1.56

Section 2 Troubleshooting 2C.1

Determining if Cause is Software or Hardware 2.1
Troubleshooting Flowchart 2.2
Troubleshooting Table 2.4
Power-related Problems 2.5
Display Problems 2.6
Sound Problems 2.6
Touch-screen Key Function Problems 2.6
Alarm Indicator Problems 2.7
Control Panel Problems 2.7

Remote Control Problems 2.7
Input Box Communication Problems 2.7
Network Problems 2.8

Section 3 Diagnostic Check 3C.1

Introduction 3.1
Power On Self Check 3.2
Calling Up the Diagnostic Check and System Setup Screen 3.3
Performing Diagnostic Checks 3.4
Calling Up the MU/VD Manual Check Menu Screen 3.5
PPC Check Menu Items 3.6
Card ROM Check 3.7
Disk Check 3.7
Network I/F Check 3.10
Serial Check 3.10
GUI Check Menu Items 3.11
Wave RAM Check 3.12
Wave Display 1 and 2 Check 3.13
Graphic Display Check 3.15
Sound 1 Check 3.16
Sound 2 Check 3.17
Touch Key I/F Check 3.18
IrDA I/F Check 3.18
Access Bus I/F Check 3.19
Temperature Sensor Check 3.20
Alarm Pole Check 3.21
JA I/F RAM Check 1 and 2 ..... 3.22
JA I/F Internal Loop Back Check 3.23
JA I/F External Loop Back Check 3.23
JA I/F Ctl Check 3.24
Keyboard I/F Check 3.24
Mouse I/F Check 3.25
AC Source Check 3.25
Fan ON/OFF Check 3.26
VD(VL) Check Menu Items 3.28
Focus Check 3.29
Viewrity Check (Graphic display check) 3.29
Configuration Check 3.30
Communication Check 3.30
Operation Unit Check 3.31
Remote Controller Check 3.32
Touch Key Check 3.33
Touch Key Calibration 3.34
Alarm Indicator Check 3.35
IrDA Check 3.36
ASK Check 3.37
HPSIR Check 3.38
Screen Setup 3.39

Degauss 3.40
Brightness 3.41
Contrast 3.42
H-Position 3.42
H-Size 3.43
V-Position 3.43
V-Size 3.44
Pincushion 3.44
Screen Save 3.45
Other Check 3.46
Keyboard Check 3.47
Mouse Check 3.48

Section 4 Board/Unit Description 4C.1

Main Unit 4.1
PPC Board 4.1
Main GUI Board and GUI Board 4.2
VD/VL Display Unit 4.3
Input Box 4.4
Modules 4.4

Section 5 Disassembly and Assembly 5C.1

Before You Begin 5.1
Warnings and Cautions 5.1
Required Tools 5.1
Main Unit 5.2
Removing the Blank Panel 5.2
Removing the Connector Holder Panel 5.3
Removing the GUI Board 5.4
Removing the PPC Board 5.5
Putting Back the Blank Panel 5.6
Putting Back the PPC and GUI Boards 5.6
Putting Back the Connector Holder Panel 5.7
Replacing the Memory Card and Boot ROM 5.8
Removing the Blank Panel, GUI Board and PPC Board 5.8
Replacing the Memory Card 5.8
Replacing the Boot ROM 5.10
Reattaching the Blank Panel, and GUI and PPC Boards 5.12
Replacing the Power Unit 5.13
Color Display Unit 5.17
Removing the Control Panel 5.17
Attaching the Blank Panel 5.18
Replacing the Control Panel 5.19

Section 6 Maintenance 6C.1

Measuring and Test Equipment 6.1
- Measuring Equipment 6.1
- Test Equipment 6.1

Maintenance Check Items and Schedule 6.2
- External 6.2
- Input Box 6.2
- Operation 6.3
- Display Unit 6.3
- Recorder Module 6.3
- Vital Sign Parameter 6.4
- Safety 6.5
- Data Backup 6.6
- Others 6.6

Maintenance Check Sheet 6.7

Section 7 Replaceable Parts List 7C.1

Section 8 Connector Pin Assignment 8C.1

Input/Output Connector Pin Assignment 8.1
- Color Display Unit, VD-900RA/RK 8.1
  - HOST Socket 8.1
- Color LCD Unit, VL-900PA/VL-910RA 8.2
  - HOST Socket 8.2
  - DC IN Socket (VL-900PA only) 8.2
- Bedside Station Main Unit, MU-980RA/RJ/RK 8.3
  - VD/VL Socket, VD/VL 8.3
  - External RGB Output Socket, RGB 8.3
  - Alarm Output Socket, ALARM 8.4
  - Mouse Socket, MOUSE 8.4
  - Keyboard Socket, KEYB 8.4
  - General Serial Socket, SERIAL 8.4
  - Network Socket, NETWORK 8.5
  - JA Socket 8.5
  - DC OUT Socket 8.6
- Input Box, JA-960PA 8.6
  - JA Input Socket 8.6
  - JA Output Socket 8.7
- Input Box, JA-980PA 8.7
  - JA Input Socket 8.7
  - JA Output Socket 8.8
- Multi Parameter Module, AY-900PA 8.8
  - ECG/BP OUT Socket 8.8
- Interface, QI-910RA/RJ/RK 8.9
  - BSM Socket 8.9
  - NETWORK 1 Socket 8.9
  - NETWORK 2 Socket 8.10

HT Input Jack 8.10
Display Connection Box, RY-900P 8.11
HOST Socket 8.11
RGB Output Socket, RGB 8.11
TOUCH PANEL Socket 8.12
DC IN Socket 8.12

EMC RELATED CAUTION

This equipment and/or system complies with the International Standard IEC60601-1-2 for electromagnetic compatibility for medical electrical equipment and/or system. However, an electromagnetic environment that exceeds the limits or levels stipulated in the IEC60601-1-2, can cause harmful interference to the equipment and/or system or cause the equipment and/or system to fail to perform its intended function or degrade its intended performance. Therefore, during the operation of the equipment and/or system, if there is any undesired deviation from its intended operational performance, you must avoid, identify and resolve the adverse electromagnetic effect before continuing to use the equipment and/or system.

The following describes some common interference sources and remedial actions:

1. **Strong electromagnetic interference from a nearby emitter source such as an authorized radio station or cellular phone:**
   Install the equipment and/or system at another location if it is interfered with by an emitter source such as an authorized radio station. Keep the emitter source such as cellular phone away from the equipment and/or system.

2. **Radio-frequency interference from other equipment through the AC power supply of the equipment and/or system:**
   Identify the cause of this interference and if possible remove this interference source. If this is not possible, use a different power supply.

3. **Effect of direct or indirect electrostatic discharge:**
   Make sure all users and patients in contact with the equipment and/or system are free from direct or indirect electrostatic energy before using it. A humid room can help lessen this problem.

4. **Electromagnetic interference with any radio wave receiver such as radio or television:**
   If the equipment and/or system interferes with any radio wave receiver, locate the equipment and/or system as far as possible from the radio wave receiver.

If the above suggested remedial actions do not solve the problem, consult your Nihon Kohden Corporation subsidiary or distributor for additional suggestions.

The CE mark is a protected conformity mark of the European Community. The products herewith comply with the requirements of the Medical Device Directive 93/42/EEC.

The CE mark only applies to the BSS-9800K Bedside Station.

This equipment complies with International Standard IEC60601-1-2 (1993) which requires CISPR11, class A. Class A EQUIPMENT is allowed in domestic establishments when used under the jurisdiction of a health care professional.

In IEC 60601-1-2 Medical Electronic Equipment, Part 1: General Requirements for Safety, 2. Collateral Standard: Electromagnetic compatibility-Requirements and test. Section 36. 202. 2 Radiated radio-frequency electromagnetic fields, PATIENT COUPLED EQUIPMENT and/or SYSTEMS applicable IMMUNITY test methods are under consideration at SC62A/WG13. The 3 V/m IMMUNITY level may be inappropriate especially when measuring SpO_2 because physiological signals can be much smaller than those induced by a 3 V/m electromagnetic field.

When measuring SpO_2, various interference may produce false waveforms which look like pulse waveforms. SpO_2 value and pulse rate may be measured from these false waveforms, causing the alarm to function improperly.

When installing the monitor, avoid locations where the monitor may receive strong electromagnetic interference such as radio or TV stations, cellular phone or mobile two-way radios.

WARNING

Interaction Between Minute Ventilation Rate-Adaptive Pacemakers and Cardiac Monitoring and Diagnostic Equipment*

The bioelectric impedance measurement sensor of a minute ventilation rate-adaptive implantable pacemaker may be affected by cardiac monitoring and diagnostic equipment which is connected to the same patient. If this occurs, the pacemaker may pace at its maximum rate and give incorrect data to the monitor or diagnostic equipment. If this occurs, disconnect the monitor or diagnostic equipment from the patient or change the setting on the pacemaker by referring to the pacemaker's manual. For more details, contact your pacemaker distributor or Nihon Kohden distributor.

* Minute ventilation is sensed in rate-adaptive pacemakers by a technology known as bioelectric impedance measurement (BIM). Many medical devices in addition to pacemakers use this technology. When one of these devices is used on a patient with an active, minute ventilation rate-adaptive pacemaker, the pacemaker may erroneously interpret the mixture of BIM signals created in the patient, resulting in an elevated pacing rate.

For more information, see the FDA web site.
http://www.fda.gov/cdrh/safety.html

Conventions Used in this Manual and Instrument

Warnings, Cautions and Notes

Warnings, cautions and notes are used in this manual to alert or signal the reader to specific information.

WARNING

A warning alerts the user to possible injury or death associated with the use or misuse of the instrument.

CAUTION

A caution alerts the user to possible injury or problems with the instrument associated with its use or misuse such as instrument malfunction, instrument failure, damage to the instrument, or damage to other property.

NOTE

A note provides specific information, in the form of recommendations, prerequirements, alternative methods or supplemental information.

Explanations of the Symbols in this Manual and Instrument

The following symbols found in this manual/instrument bear the respective descriptions as given.

On panels

Symbol	Description	Symbol	Description
	Standby		Type BF applied part
	“On” only for a part of instrument		Input terminal
	“Off” only for a part of instrument		Output terminal
	Alternating current	IPX4	Splash-proof equipment
	Equipotential terminal	IPX7	Watertight equipment
	Attention, consult operator’s manual		High voltage
	Alarm off/suspend		Protective earth
	NIBP		Year of manufacture
	Defibrillation-proof type CF applied part	SN	Serial number
	Type CF applied part		The CE mark is a protected conformity mark of the European Community. The products herewith comply with the requirements of the Medical Device Directive 93/42/EEC.
	Defibrillation-proof type BF applied part		

On screen

Symbol	Description	Symbol	Description
	Open Main menu window		Print button
	Open pulldown menu		Alarm off/suspend
	Open Alarm window		Alarm off/suspend with remaining time
	Close window button	ARR	Arrhythmia analysis off
	QRS sync mark		Measuring NIBP on neonate
	Record		Cuff inflation pressure limiter for neonates is turned off (NIBP)

Section 1 General

Introduction 1.1
General Information on Servicing 1.2
Service Policy, Service Parts and Patient Safety Checks 1.4
- Service Policy 1.4
- Service Parts 1.4
- Patient Safety Checks 1.5

Composition 1.6
- Bedside Station Main Unit 1.6
- GUI Board (Option) 1.6
- Color Display Unit (Option) 1.6
- Color LCD Unit (Option) 1.7
- Color LCD Unit (Option) 1.7
- Input Boxes (Option) 1.7
- Modules (Option) 1.8
- Recorder Unit (Option) 1.11
- CCO Unit (Option) 1.11
- Display Connection Box (Option) 1.11
- Multi Gas Unit (Option) 1.11
- Multigas Unit (Option) 1.12
- Flash ROM Disk (Option) 1.12
- Cart (Option) 1.12
- Isolation Transformer (Option) 1.12
- Interface (Option) 1.12

Specifications 1.13
- Bedside Station Main Unit, BSS-9800A/J/K 1.13
- Dimensions and Weight (Approximate) 1.13
- Displays 1.13
- Sound 1.14
- Alarm 1.14
- Central Monitor 1.14
- Power Requirement 1.14
- Environment 1.15
- Clock Accuracy 1.15
- Electromagnetic Compatibility 1.15

Safety Standard 1.15
Color Display Unit, VD-900RA/RK (Bedside Monitor) (Discontinued) 1.16
Color Display Unit, VD-900RA/RK (Central Monitor) (Discontinued) 1.16
Color LCD Unit, VL-900PA (Bedside Monitor) 1.16
Color LCD Unit, VL-900PA (Central Monitor) 1.17
Color LCD Unit, VL-910RA (Bedside Monitor) 1.17
Color LCD Unit, VL-910RA (Central Monitor) 1.17
Trendgraph 1.17
Full Disclosure 1.18
Input Box, JA-960PA 1.18
Input box, JA-980PA 1.18
Multi Parameter Module, AY-900PA 1.18
ECG 1.18
Respiration (Transthoracic impedance pneumography) 1.20
SpO_2 and Pulse Wave (Arterial Plethysmographic Waveform) 1.20
Non-invasive Blood Pressure, NIBP 1.20
Multi Amplifiers 1.21
Invasive Blood Pressure, IBP 1.21
Temperature 1.22
Cardiac Output, CO 1.22
Respiration (Thermistor probe pneumography) 1.23
Inspired Oxygen Fractional Concentration, FiO_2 ..... 1.23
Expired Carbon Dioxide Tension, CO_2 ..... 1.24
ECG/BP Output 1.24
Multi Parameter Module, AY-910PA 1.25
SpO_2 and Pulse Wave (Arterial Plethysmographic Waveform) 1.25
Recorder Module WS-920PA and Recorder Unit WS-921RA/RJ/RK 1.25
BIS Module, AE-900PA 1.25
EEG Module, AE-910PA 1.26
FLOW/Paw Module, AF-900PA 1.26
$S\bar{v}O_2$ Module, AL-910PA 1.26
CO_2 Module, AG-900PA 1.27
Multi Gas Unit, AG-910RA/RK 1.27
Multigas Unit, AG-920RA/RK 1.29
CCO Unit, AH-900RA/RJ/RK 1.30
Interface, QI-910RA/RJ/RK 1.30
Names and Function of Parts 1.32
Control Panel 1.32
Remote Control 1.33
Color Display Unit 1.34
Front Panel 1.34
Rear Panel 1.34
Color LCD Unit (VL-900PA) 1.35
Front panel 1.35
Right Side Panel 1.35
Color LCD Unit (VL-910RA) 1.36
Front panel 1.36
Right Side Panel 1.36

Main Unit 1.37
Front Panel 1.37
Side Panel 1.37
Rear Panel 1.38
Input Box 1.39
Front Panel 1.39
Rear Panel 1.39
Input Box 1.40
Front Panel 1.40
Left Side Panel 1.40
Right Side Panel 1.40
Multi Parameter Module 1.41
Smart Module 1.43
Recorder Module 1.44
BIS Module 1.44
EEG Module 1.45
FLOW/Paw Module 1.45
$S\bar{v}O_2$ Module 1.46
CO_2 Module 1.46
Multi Gas Unit (AG-910RA/RK) 1.47
Front Panel 1.47
Rear Panel 1.47
Multigas Unit (AG-920RA/RK) 1.48
Front Panel 1.48
Rear Panel 1.48
CCO Unit 1.49
Front Panel 1.49
Rear Panel 1.49
Recorder Unit 1.50
Front Panel 1.50
Rear Panel 1.50
Display Connection Box 1.51
Front Panel 1.51
Rear Panel 1.51
Interface 1.52
Front Panel 1.52
Rear Panel 1.52
Block Diagram 1.53
MU-980RA/RJ/RK Main Unit 1.53
VD-900RA/RK Color Display Unit 1.54
VL-900PA Color LCD Unit 1.55
VL-910RA Color LCD Unit 1.56

Introduction

This service manual provides useful information to qualified personnel to understand, troubleshoot, service, maintain and repair the BSS-9800A/J/K Bedside Station (referred to as “the instrument” in this service manual).

All replaceable parts or units of this instrument are clearly listed with exploded illustrations to help you locate the parts quickly.

The “Maintenance” section in this service manual describes the maintenance that should be performed by qualified service personnel. The “Maintenance” section in the operator’s manual describes the maintenance that can be performed by the user.

The information in the operator’s manual is primarily for the user. However, it is important for service personnel to thoroughly read the operator’s manual and service manual before starting to troubleshoot, service, maintain or repair this instrument. This is because service personnel need to understand the operation of the instrument in order to effectively use the information in the service manual.

General Information on Servicing

Note the following information when servicing the instrument.

CAUTION

Safety

- **There is the possibility that the outside surface of the instrument, such as the operation keys, could be contaminated by contagious germs, so disinfect and clean the instrument before servicing it. When servicing the instrument, wear rubber gloves to protect yourself from infection.**
- **There is the possibility that when the lithium battery is broken, a solvent or toxic substance inside the lithium battery could leak out. If the solvent or toxic substance touches your skin or gets into your eye or mouth, immediately wash it with a lot of water and see a physician.**

Liquid ingress

The instrument is not drip-proof, so do not install the instrument where water or liquid can get into or fall on the instrument. If liquid accidentally gets into the instrument or the instrument accidentally drops into liquid, disassemble the instrument, clean it with clean water and dry it completely. After reassembling, use the patient safety checks and function/performance checks to verify that there is nothing wrong. If there is something wrong with the instrument, contact your Nihon Kohden representative for repair.

Environmental Safeguards

Depending on the local laws in your community, it may be illegal to dispose of the lithium battery and CRT unit in the regular waste collection. Check with your local officials for proper disposal procedures.

Disinfection and cleaning

To disinfect the outside surface of the instrument, wipe it with a non-abrasive cloth moistened with any of the disinfectants listed below. Do not use any other disinfectants or ultraviolet rays to disinfect the instrument.

- **Chlorohexidine gluconate solution: 0.5%**
- **Benzethonium chloride solution: 0.2%**
- **Glutaraldehyde solution: 2.0%**
- **Benzalkonium chloride: 0.2%**
- **Hydrochloric alkyl diaminoethylglycine: 0.5%**

Transport

- **Use the specified shipment container and packing material to transport the instrument. If necessary, double pack the instrument. Also, put the instrument into the shipment container after packing so that the buffer material does not get inside the instrument.**
- **When transporting a board or unit of the instrument, be sure to use a conductive bag. Never use an aluminum bag when transporting the power board, power unit or board on which a lithium battery is mounted. Also, never wrap the board or unit of the instrument with styrene foam or a plastic bag which generates static electricity.**

Handling the instrument

- **Because the outside surface of the instrument is made of resin, it is easily damaged. When handling the instrument, remove clutter from around the instrument and be careful not to damage the instrument or get it dirty.**
- **Because most of the boards in the instrument are multilayer boards with surface mounted electrical devices (SMD), a special tool is required when removing and soldering the electrical devices. To avoid damaging other electrical components, do not remove and solder SMD components yourself.**

Measuring and Test Equipment

Maintain the accuracy of the measuring and test equipment by checking and calibrating it according to the check and calibration procedures.

Service Policy, Service Parts and Patient Safety Checks

Service Policy

Our technical service policy for this instrument is to replace the faulty unit, board or part or damaged mechanical part with a new one. Do not perform electrical device or component level repair of the multilayer board or unit. We do not support component level repair outside the factory for the following reasons:

- Most of the boards are multilayer boards with surface mounted electrical devices, so the mounting density of the board is too high.
- A special tool and special repair skill is required to repair the multilayer boards with surface mounted electrical devices.

Disassemble the instrument or replace a board or unit in an environment where the instrument is protected against static electricity.

As background knowledge for repair, pay special attention to the following:

- You can reduce the repair time by considering the problem before starting repair.
- You can clarify the source of most of the troubles using the information from the diagnostic check function of the instrument. Refer to "Diagnostic Check " of this manual.

Service Parts

Refer to "Replaceable Parts List" of this manual for the service parts for technical service that we provide.

NOTE

When ordering parts or accessories from your Nihon Kohden representative, please quote the NK code number and part name which is listed in this service manual, and the name or model of the unit in which the required part is located. This will help us to promptly attend to your needs. Always use parts and accessories recommended or supplied by Nihon Kohden Corporation to assure maximum performance from your instrument.

Patient Safety Checks

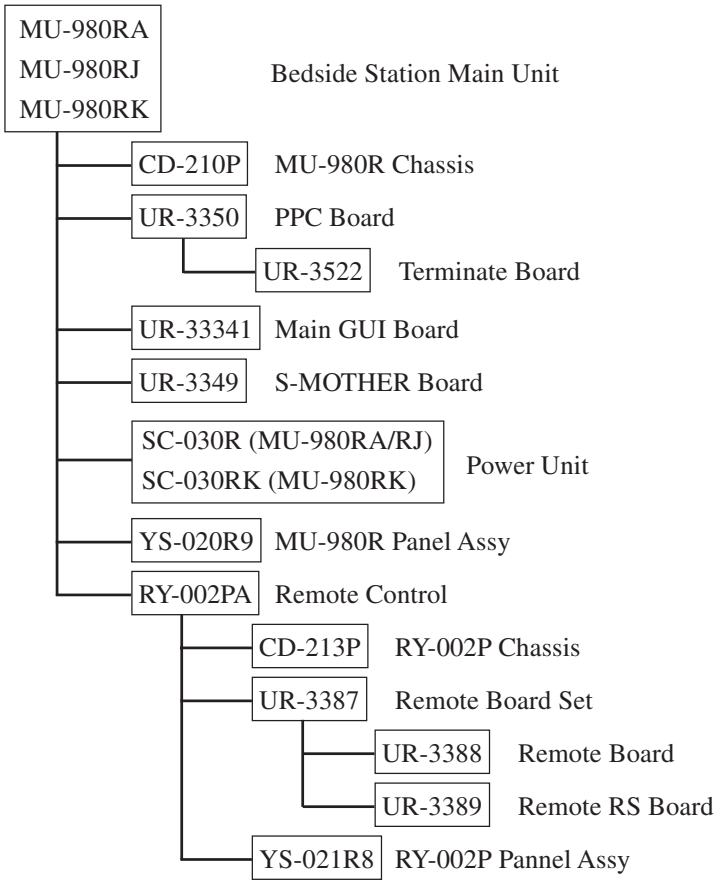
Periodic maintenance procedures and diagnostic check procedures are provided in this manual to ensure that the instrument is operating in accordance with its design and production specifications. To verify that the instrument is working in a safe manner with regard to patient safety, patient safety checks should be performed on the instrument before it is first installed, periodically after installation, and after any repair is made on the instrument.

For patient safety checks, perform the following checks as described in the International Electrotechnical Commission's standard, IEC60601-1 (1988):

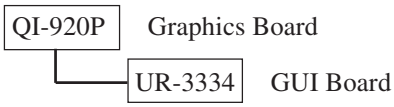
- Protective earth resistance check
- Earth leakage current check
- Enclosure leakage current check
- Patient leakage current check
- Withstanding voltage check

Composition

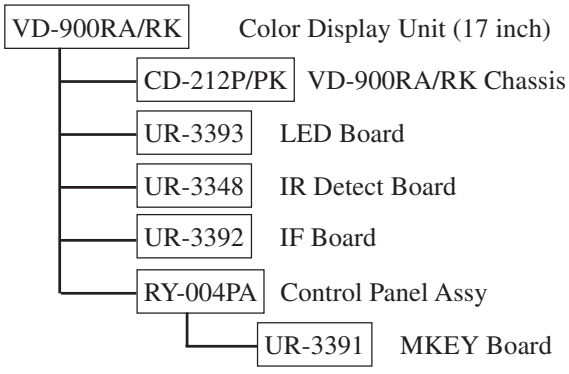
Bedside Station Main Unit



GUI Board (Option)



Color Display Unit (Option)



Color LCD Unit (Option)

- VL-900PA Color LCD Unit (10.4 inch)
  - CD-211P VL-900P Chassis
  - UR-3393 LED Board
  - UR-3348 IR Detect Board
  - UR-3392 IF Board
  - RY-004PA Control Panel Assy
    - UR-3391 MKEY Board

Color LCD Unit (Option)

- VL-910RA Color LCD Unit (15 inch)
  - UR-3393 LED Board
  - UR-3348 IR Detect Board
  - UR-3506 OPE Board

Input Boxes (Option)

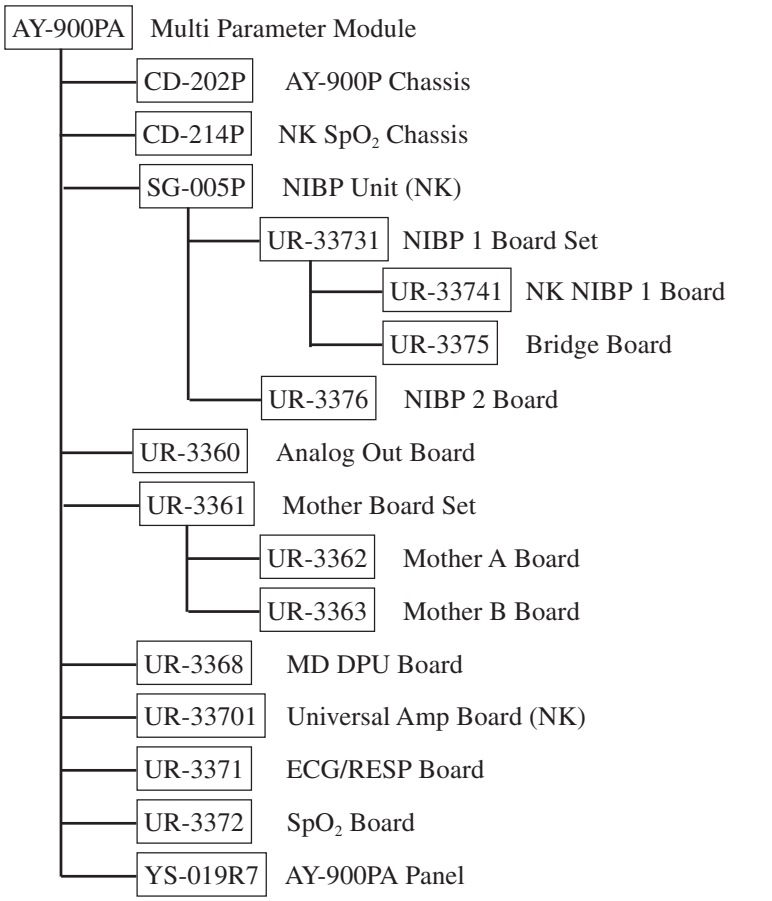
- JA-960PA Input Box (6 slots)
  - CD-199P JA-960P Chassis
  - UR-3359 JA Mother 6 Board

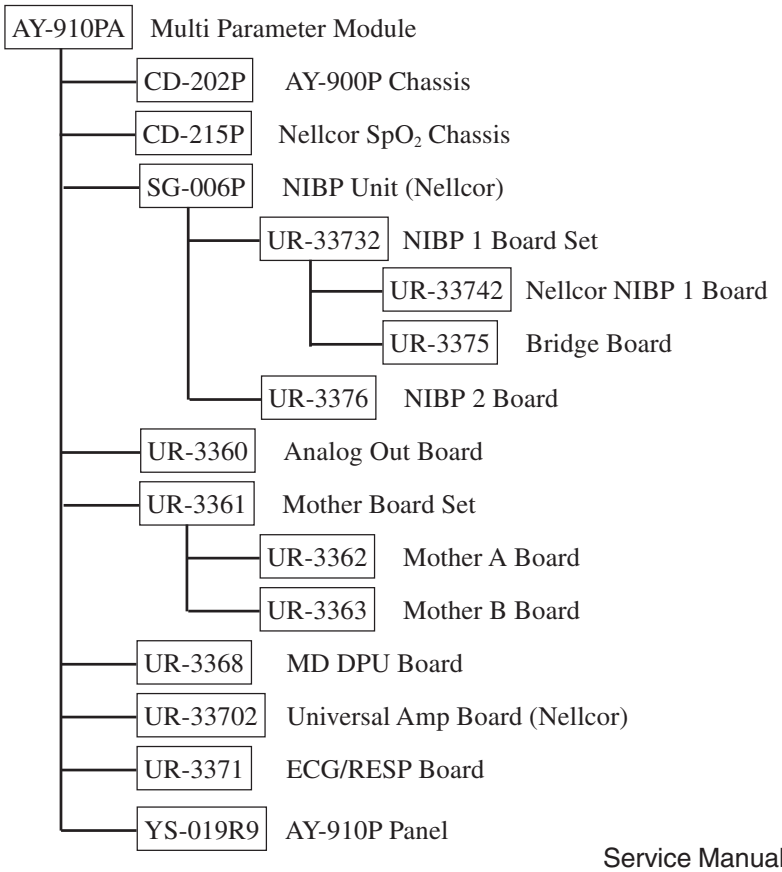
- JA-980PA Input Box (8 slots)
  - CD-198P JA-980P Chassis
  - UR-3358 JA Mother 8 Board

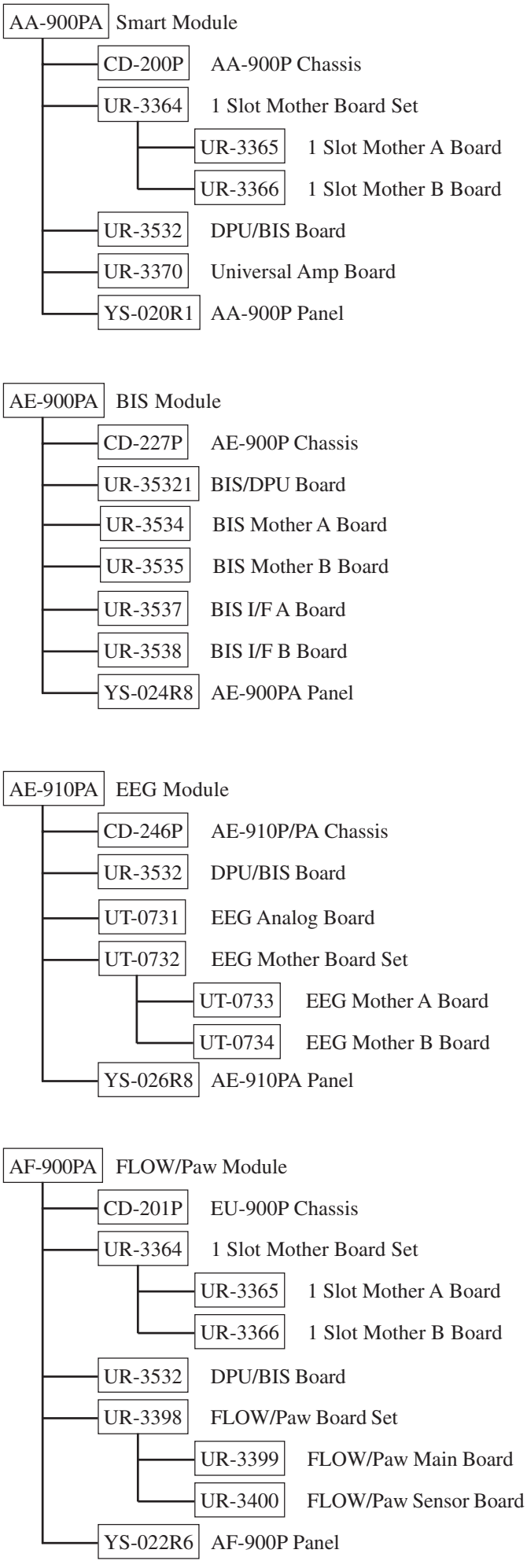
CAUTION

The components, including board and unit, in each module or unit are not locally replaceable.

Modules (Option)






AA-900PA Smart Module
CD-200P AA-900P Chassis
UR-3364 1 Slot Mother Board Set
UR-3365 1 Slot Mother A Board
UR-3366 1 Slot Mother B Board
UR-3532 DPU/BIS Board
UR-3370 Universal Amp Board
YS-020R1 AA-900P Panel
AE-900PA BIS Module
CD-227P AE-900P Chassis
UR-35321 BIS/DPU Board
UR-3534 BIS Mother A Board
UR-3535 BIS Mother B Board
UR-3537 BIS I/F A Board
UR-3538 BIS I/F B Board
YS-024R8 AE-900PA Panel
AE-910PA EEG Module
CD-246P AE-910P/PA Chassis
UR-3532 DPU/BIS Board
UT-0731 EEG Analog Board
UT-0732 EEG Mother Board Set
UT-0733 EEG Mother A Board
UT-0734 EEG Mother B Board
YS-026R8 AE-910PA Panel
AF-900PA FLOW/Paw Module
CD-201P EU-900P Chassis
UR-3364 1 Slot Mother Board Set
UR-3365 1 Slot Mother A Board
UR-3366 1 Slot Mother B Board
UR-3532 DPU/BIS Board
UR-3398 FLOW/Paw Board Set
UR-3399 FLOW/Paw Main Board
UR-3400 FLOW/Paw Sensor Board
YS-022R6 AF-900P Panel

- AG-900PA CO_2 Module
  - CD-204P AG-900P Chassis
  - CD-203P Sensor Chassis (Spegas holder)
  - UR-3354 CO_2 Mother Board Set
    - UR-3355 CO_2 Mother A Board
    - UR-3356 CO_2 Mother B Board
  - UR-3357 CO_2 I/F Board
  - UR-3532 DPU/BIS Board
  - YS-022R7 AG-900P Panel

- AL-910PA $S\bar{v}O_2$ Module
  - CD-205P AL-910P Chassis
  - UR-3532 DPU/BIS Board
  - UR-3378 $S\bar{v}O_2$ Mother Board Set
    - UR-3379 $S\bar{v}O_2$ Mother A Board
    - UR-3380 $S\bar{v}O_2$ Mother B Board
  - UR-3505 $S\bar{v}O_2$ Board Set
  - YS-022R8 AL-910P Panel

- EU-900PA Interface Module
  - CD-201P EU-900P Chassis
  - UR-3364 1 Slot Mother Board Set
    - UR-3365 1 Slot Mother A Board
    - UR-3366 1 Slot Mother B Board
  - UR-3532 DPU/BIS Board
  - UR-3377 EXT I/F Board
  - YS-020R3 EU-900P Panel

- WS-920PA Recorder Module
  - CD-206P WS-920P Chassis
  - RG-920P Drive Unit
    - WS-751X Drive Unit Assy
  - UR-3532 DPU/BIS Board
  - UR-3395 REC Control Board
  - UR-3397 WS Mother Board
  - YS-021R4 WS-920P Panel

- EK-900P Blank Module

Recorder Unit (Option)

- WS-921RA/RJ/RK Recorder Unit
  - CD-206P WS-920P Chassis
  - RG-920P Drive Unit
    - WS-751X Drive Unit Assy
  - CD-224P WS-921R Chassis
  - UR-3532 DPU/BIS Board
  - UR-3395 REC Control Board
  - UR-3397 WS Mother Board
  - UR-3539 WS-921R COM Board
  - YS-021R4 WS-920P Panel
  - SC-038R WS-921R Power Supply Unit

CCO Unit (Option)

- AH-900RA/RJ/RK CCO Unit
  - CD-208P CCO Unit Chassis
  - CD-209P Super Module
  - SC-033R CCO Power Unit
  - UR-3532 DPU/BIS Board
  - UR-3407 CCO Board Set
    - UR-3448 CCO Mother Board
    - UR-3449 CCO Bridge Board
    - UR-3451 CCO SW Board
  - UR-3450 CCO Communication Board
  - YS-022R9 AH-900RA Panel
    YS-023R0 AH-900RJ Panel
    YS-023R1 AH-900RK Panel

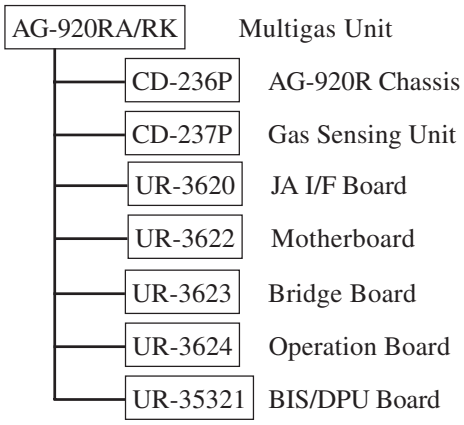
Display Connection Box (Option)

- RY-900P Display Connection Box
  - UR-3552 KEY CONT Board
  - UR-3353 KEY-LED Board
  - YS-072P4 Connector Assy

Multi Gas Unit (Option)

AG-910RA/RK Multi Gas Unit

Multigas Unit (Option)



Flash ROM Disk (Option)

QM-900P Flash ROM Disk

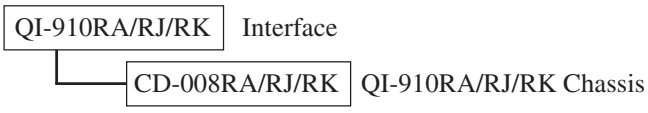
Cart (Option)

KD-007P Cart

Isolation Transformer (Option)

SM-800RA/RJ/RK Isolation Transformer

Interface (Option)



Specifications

Bedside Station Main Unit, BSS-9800A/J/K

For other details, refer to the specifications of the respective module and unit.

Dimensions and Weight (Approximate)

MU-980RA/RJ/RK Main Unit:	389 W × 140 H × 347 D mm, 10.5 kg
VD-900RA/RK Color Display Unit:	470 W × 408 H × 457 D mm, 27 kg
VL-900PA Color LCD Unit:	374 W × 305 H × 81 D mm, 4 kg
VL-910RA Color LCD Unit:	483 W × 380 H × 118 D mm, 7.3 kg
JA-980PA Input Box:	350 W × 141 H ×191 D mm, 1.6 kg
JA-960PA Input Box:	149 W × 273 H × 191 D mm, 1.7 kg
AY-900PA/910PA Multi Parameter Module:	113 W × 117 H × 160 D mm, 1.5 kg
AA-900PA Smart Module:	37 W × 117 H × 160 D mm, 0.4 kg
RY-002PA Remote Control:	50 W × 22 H × 162 D mm, 0.09kg
WS-920PA Recorder Module:	113 W × 117 H × 160 D mm, 0.8 kg
EK-900P Blank Module:	37 W × 117 H × 160 D mm, 0.17 kg
AE-900PA BIS Module:	75 W × 117 H × 160 D mm, 0.7 kg
AE-910PA EEG Module:	37 W × 117 H × 160 D mm, 0.4 kg
AF-900PA FLOW/Paw Module:	37 W × 117 H × 160 D mm, 0.4 kg
AL-910PA $S\bar{v}O_2$ Module:	75 W × 117 H × 160 D mm, 0.55 kg
AG-900PA CO_2 Module:	75 W × 117 H × 160 D mm, 0.7 kg
AG-910RA/RK Multi Gas Unit:	183 W × 146 H × 431 D mm, 7.6 kg
AG-920RA/RK Multigas Unit:	180 W × 140 H × 220 D mm, 3.4 kg
AH-900RA/RJ/RK CCO Unit:	180 W × 143 H × 400 D mm, 5 kg
WS-921RA/RJ/RK Recorder Unit:	123.4 W × 170 H × 193 D mm, 2.4 kg
QI-910RA/RJ/RK Interface:	85 W × 180 H × 230 D mm, 3.2 kg
QI-920P Graphics Board:	262 W × 21.5 H × 280.7 D mm, 0.5 kg
QM-900P Flash ROM Disk:	86.5 W × 5 H × 54 D mm, 0.3 kg
RY-900P Display Connection Box:	60 W × 125 H × 202 D mm, 1 kg

Displays

Color:	12 colors for waveforms, 32 colors for numericals, colors selectable
Sweep speed:	6, 25 or 50 mm/s
Display waveforms:	ECG, IBP, ICP, SpO_2, Respiration wave, CO_2, Flow, Paw, and other parameters depending on the module and unit
Numerical data display:	Heart rate, VPC rate, arrhythmia message, ST level, IBP (systolic, diastolic, mean), NIBP (systolic, diastolic, mean), respiration rate, pulse rate, temperature, SpO_2, CO_2, O_2, and other parameters depending on the module and unit.
Synchronization mark:	Heart rate sync mark, pulse rate sync mark

Sound

Sound type:	Alarm, synchronization, click
Alarm sound:	Volume variable
Synchronization sound:	Volume variable
Click sound:	Volume/pitch variable

Alarm

Alarm items:	Upper/lower limits alarm, apnea alarm, arrhythmia alarm, module alarm, external instrument alarm, electrode check alarm, faulty instrument alarm, connector disconnection alarm, operating environment alarm
Alarm types:	Crisis (red, blinking), Warning (yellow, blinking), Advisory (yellow, lighting), Message, System Guidance
Alarm indication:	Alarm indicator, highlighted numerical display, numerical display color, alarm sound, highlighted message for arrhythmia
Alarm suspend:	Provided (For 1, 2, 3, 4, 5, 10 min)
Alarm silence:	Provided (For 1, 2, 3, 4, 5, 10 min)
Alarm setting:	Individual upper/lower limits setting for each parameter

Central Monitor

Number of managed beds:	4, 6, 8, 10, 12 or 16
Displayed data:	Bedside monitor data displayed in automatic or manual layout

Power Requirement

- Main Unit, MU-980RA/RJ/RK

Line voltage:	MU-980RA: AC 117 V ±10% MU-980RJ: AC 100 to 127 V ±10% MU-980RK: AC 220 to 240 V ±10%
Line frequency:	50 or 60 Hz
Power consumption:	640 VA maximum, including the color display unit

- Color Display Unit, VD-900RA/RK

Line voltage:	VD-900RA: AC 100 to 127 V ±10% VD-900RK: AC 220 to 240 V ±10%
Line frequency:	50 or 60 Hz
Power consumption:	255 VA maximum

- Color LCD Unit, VL-900PA

Input voltage:	DC 24 V ±5%
Power consumption:	43 VA maximum

- Color LCD Unit, VL-910RA

Line voltage:	AC 100 to 240 V ±10%
Line frequency:	50 or 60 Hz
Power consumption:	77 VA rated

Environment

- Operating environment

Temperature:	10 to 40°C (50 to 104°F) excluding recording paper (VL-900PA, VL-910RA: 10 to 35°C, 50 to 95°F)
Humidity:	30 to 90% RH (10 to 40°C, 50 to 104°F non-condensing) (VL-900PA: 10 to 35°C, 50 to 95°F non-condensing) (VL-910RA: 10 to 35°C, 50 to 95°F non-condensing, maximum wet-bulb temperature below 29°C)
Atmospheric pressure:	70 to 106 kPa

- Storage environment

Temperature:	–20 to 65°C (–4 to 149°F) excluding recording paper (VL-900PA, VL-910RA: –20 to 60°C, –4 to 140°F)
Humidity:	15 to 90% RH (non-condensing) (VL-910RA: 10 to 95% non-condensing)
Atmospheric pressure:	70 to 106 kPa

Clock Accuracy

At operating temperature 25°C: about ±3 min/month maximum
At storage temperature –20 to 60°C: about ±5 min/month maximum

Electromagnetic Compatibility

IEC 60601-1-2 (1993) Group 1, Class A

Safety Standard

Safety Standard: IEC 60601-1 (1988)
IEC 60601-1 (1991) Amendment 1
IEC 60601-1 (1995) Amendment 2
IEC 60601-1-1 (1992)
IEC 60601-1-1 (1995) Amendment 1
IEC 60601-2-27 (1994) Particular requirements for the safety of electrocardiographic monitoring
IEC 60601-2-30 (1995) Particular requirements for the safety of automatic cycling indirect blood pressure monitoring equipment
IEC 60601-2-34 (1994) Particular requirements for the safety of direct blood pressure monitoring equipment

According to the type of protection against electrical shock:
CLASS I EQUIPMENT

According to the degree of protection against electrical shock:

AY-900PA/910PA: Defibrillator-proof type CF applied part: ECG, Resp (impedance), SpO_2, NIBP, IBP, Temp, Resp (thermistor), FiO_2
CF applied part: CO
BF applied part: CO_2 (mainstream)

AA-900PA: Defibrillator-proof type CF applied part: IBP, Temp, Resp (thermistor), FiO_2
CF applied part: CO
BF applied part: CO_2 (mainstream)

According to the degree of protection against harmful ingress of water:
IPX0 (Ordinary EQUIPMENT)
According to the degree of safety of application in the presence of a FLAMMABLE ANAESTHETIC MIXTURE WITH AIR, OR OXYGEN OR NITROUS OXIDE:
EQUIPMENT not suitable for use in the presence of FLAMMABLE ANAESTHETIC MIXTURE WITH AIR, OR WITH OXYGEN OR NITROUS OXIDE
According to the mode of operation:
CONTINUOUS OPERATION

Color Display Unit, VD-900RA/RK (Bedside Monitor) (Discontinued)

Display size:	17 inch
Viewing area:	300 × 225 mm
Resolution:	1024 × 768 dots
Number of waveform traces:	11 max. (For blood pressure separate scale)
	12 max. (For blood pressure common scale)
Sweep time:	9.2 s (When sweep speed is 25 mm/s)
Waveform display mode:	Moving mode
Touch screen:	Electrostatic method

Color Display Unit, VD-900RA/RK (Central Monitor) (Discontinued)

Display size:	17 inch
Viewing area:	300 × 225 mm
Resolution:	1024 × 768 dots
Screen configuration:	All beds screen (4, 6, 8, 10, 12 or 16 patients waveforms and data), Individual bed screen (Same as bedside monitor display, all patient display area on the left side)
Number of waveform traces:	
All beds screen	When all beds screen displays 4, 6 or 8 patients, max. 2 traces/patient
	When all beds screen displays 10, 12 or 16 patients, 1 trace/patient
Individual bed screen	Individual bed display area: Same as bedside monitor display
	All beds display area: 1 trace
Sweep time:	9.2 s (When sweep speed is 25 mm/s)
Waveform display mode:	Moving mode or Fixed mode
Touch screen:	Electrostatic method

Color LCD Unit, VL-900PA (Bedside Monitor)

Display size:	10.4 inch
Viewing area:	211 × 158 mm
Resolution:	640 × 480 dots
Number of waveform traces:	6 max. (For blood pressure separate scale)
	12 max. (For blood pressure common scale)
Sweep time:	6.4 s (When sweep speed is 25 mm/s)
Waveform display mode:	Moving mode
Touch screen:	Optical scanning method

Color LCD Unit, VL-900PA (Central Monitor)

Display size:	10.4 inch
Viewing area:	211 × 158 mm
Resolution:	640 × 480 dots
Screen configuration:	All beds screen (4, 6, 8, 10, 12 or 16 patients waveforms and data), Individual bed screen (Same as bedside monitor display, no all patient display area)
Number of waveform traces:	
All beds screen	When all beds screen displays 4, 6 or 8 patients, 1 trace/patient When all beds screen displays 10, 12 or 16 patients, no trace
Individual bed screen	Individual bed display area: Same as bedside monitor display All beds display area: no display
Sweep time:	6.4 s (When sweep speed is 25 mm/s)
Waveform display mode:	Moving mode or Fixed mode
Touch screen:	Optical scanning method

Color LCD Unit, VL-910RA (Bedside Monitor)

Display size:	15 inch
Viewing area:	304 × 228 mm
Resolution:	1024 × 768 dots
Number of waveform traces:	11 max. (For blood pressure separate scale) 12 max. (For blood pressure common scale)
Sweep time:	9.2 s (When sweep speed is 25 mm/s)
Waveform display mode:	Moving mode
Touch screen:	Optical scanning method

Color LCD Unit, VL-910RA (Central Monitor)

Display size:	15 inch
Viewing area:	304 × 228 mm
Resolution:	1024 × 768 dots
Screen configuration:	All beds screen (4, 6, 8, 10, 12 or 16 patients waveforms and data), Individual bed screen (Same as bedside monitor display, no all patient display area)
Number of waveform traces:	
All beds screen	When all beds screen displays 4, 6 or 8 patients, 2 traces/patient When all beds screen displays 10, 12 or 16 patients, 1 trace/patient
Individual bed screen	Individual bed display area: Same as bedside monitor display All beds display area: 1 trace
Sweep time:	9.2 s (When sweep speed is 25 mm/s)
Waveform display mode:	Moving mode or Fixed mode
Touch screen:	Optical scanning method

Trendgraph

Trend parameters:	Depend on the measuring parameters Heart rate, VPC rate, ST level, IBP (systolic, diastolic, mean), NIBP (systolic, diastolic, mean), respiration rate, pulse rate, temperature, SpO_2, $EtCO_2$, FiO_2 and other

Number of displayed trendgraphs:	VD-900RA/K, VL-910RA: max 8 VL-900PA: max 6
Trend time:	30 min, 1, 2, 4, 6, 8, 12 or 24 h, 48 h with QM-900P flash ROM disk, 72 h with NFS-9000K network file server (on central monitor only)
Vital signs list items:	Depend on the measuring parameters Heart rate, ST ,VPC, respiration rate, temperature, NIBP (systolic, diastolic, mean), SpO_2, IBP (systolic, diastolic, mean), FiO_2, $EtCO_2$ and other

Full Disclosure

Storage duration:	24 h, 72 h with NFS-9000K network file server (on central monitor only)
Number of waveforms:	1, 6 with NFS-9000K network file server (on central monitor only)
Waveform duration:	VD-900RA/K, VL-910RA: 8 s VL-900PA: 6 s
Actual size display:	2 h, 24 h with QM-900P flash ROM disk, 72 h with NFS-9000K network file server (on central monitor only)

Input Box, JA-960PA

Number of slots:	6

Input box, JA-980PA

Number of slots:	8

Multi Parameter Module, AY-900PA

ECG

- Electrode offset potential tolerance: ± 500 mV
- Input dynamic range: ±10 mV
- Internal noise: ≤ 20 μVp-p, referred to input
- Input impedance: ≥ 5 MΩ (at 10 Hz)
- Common Mode Rejection Ratio: ≥ 95 dB (with a 51 kΩ/47 nF imbalance)
- Input bias current: $\leq 1 \times 10^{-7}$ A
- Heart rate count

Calculation method:	8-beat moving average/Instantaneous beat-to-beat (consecutive 2 beats averaged) (Selectable)
Counting range:	15 to 300 beats/min

- Arrhythmia analysis

Analysis method:	Multi-template matching method
Number of analyzing leads:	2 (1 when monitoring with 3 electrodes or electrodes off)
VPC counting range:	0 to 99 beats/min
Arrhythmia analysis:	ASYSTOLE, V FIB, Vf/VT, EXT TACHY, EXT BRADY, V TACHY, VPC RUN, COUPLET, EARLY VPC, BIGEMINY, FREQ VPC, TACHY, BRADY, PROLONGED RR, MULTI FORM

- Arrhythmia recall

  Number of recall files: 100, 256 with NFS-9000K network file server (on central monitor only)

  Storage time per file: 8 s

- ST level measurement

  Number of measurement channels: 3-electrode: 1 ch
  6-electrode: max. 8 ch
  10-electrode: max. 12 ch

  Measuring range: ±2.5 mV

  Number of recall files: 360 (6 h for 12 leads), 1440 (24 h for 12 leads) with QM-900P flash ROM disk, 4320* (72 h for 12 leads) with NFS-9000K network file server (on central monitor only)

  * When the displaying interval is set to 1 minute, up to 1200 files can be displayed. When the interval is set to 5 minutes or longer, all saved files can be displayed.

- Pacemaker pulse rejection capability: ANSI/AAMI EC 13-1992 compatible
- Defibrillation-proof: ECG input protected against 400 J discharge
- ESU interference filter: Provided
- AC hum filter: Provided
- Lead

  3-electrode cable: I, II, III

  6-electrode cable: I, II, III, aV_R, aV_L, aV_F and any 2 leads from chest leads

  10-electrode cable: I, II, III, aV_R, aV_L, aV_F, V1 to V6

- ECG frequency range

  Signal bandwidth: DC to 90 Hz

  Display bandwidth:

Filter	Drift free	
Off	Off	0.3 to 70 Hz
On	Off	0.3 to 20 Hz
Off	On	1.0 to 70 Hz
On	On	1.0 to 20 Hz

- Waveform display

  Display sensitivity: 10 mm/mV ±5% (at ×1 sensitivity)

  Sensitivity control: ×1/4, ×1/2, ×1, ×2, ×4 or Auto

  Drift rejection filter: Available

  Pacing spike display: Available

  Auto positioning: Available

- Heart rate display update cycle: Every 3 s or when alarm is generated
- Alarm

  Upper limit range: 20 to 300 beats/min in 5 beats/min steps, Off

  Lower limit range: Off, 15 to 295 beats/min in 5 beats/min steps

  Alarm items: TACHY, BRADY

- ECG output: 1 V/mV ±5%

Respiration (Transthoracic impedance pneumography)

- Measuring impedance range: ≤ 2 kΩ
- Internal noise: ≤ 0.1 Ω
- Excitor current: 30 ±10 μArms at 40 kHz
- Frequency response: 0.1 to 3 Hz (–3 dB)
- Respiration counter
  - Counting range: 0 to 150 breaths/min
  - Counting accuracy: ±1 breath/min
  - Apnea setting range: 5 to 40 s (set on the main unit)
- Defibrillation proof: Respiration input protected against 400 J discharge
- Waveform display
  - Display sensitivity: 10 mm/Ω (at ×1 sensitivity)
  - Sensitivity control: ×1/8, ×1/4, ×1/2, ×1, ×2, ×4, ×8 or Auto
- Respiration rate display update cycle: Every 3 s or when alarm is generated
- Alarm
  - Upper limit range: 2 to 150 breaths/min in 2 breaths/min steps, Off
  - Lower limit range: Off, 0 to 148 breaths/min in 2 breaths/min steps
  - Apnea time: 5 to 40 s in 5 s steps, Off

SpO_2 and Pulse Wave (Arterial Plethysmographic Waveform)

With Nihon Kohden probe

- Measuring range
  - SpO_2: 1 to 100% in 1% steps
  - Pulse rate: 30 to 300 beats/min
- SpO_2 accuracy
  - 80 to 100% SpO_2: ±2% SpO_2
  - 50 to 80% SpO_2: ±3% SpO_2
- SpO_2 display
  - Pulse rate display update cycle: Every 3 s or when alarm is generated
  - Sync tone modulation: Changes in 20 steps at 81 to 100% SpO_2
- Alarm
  - Upper limit range: 51 to 100% SpO_2 in 1% steps, Off
  - Lower limit range: Off, 50 to 99% SpO_2 in 1% steps
  - delta SpO_2: Off, 1 to 99% SpO_2

Non-invasive Blood Pressure, NIBP

- Measuring method: Oscillometric
- Measuring range: 0 to 300 mmHg (0 to 40 kPa)
- Cuff pressure display range: 0 to 300 mmHg (0 to 40 kPa)
- Accuracy
  - 0 to 200 mmHg: ±3 mmHg
  - 200 to 300 mmHg: ±4 mmHg

- Safety

  Maximum pressurization value cuff inflation limiter: Adult 300 mmHg
  Neonate 150 mmHg
  Cuff inflation time limiter: Adult 150 s
  Neonate 80 s

- Measurement mode: Manual (Single measurement)
  STAT (Successive repetition or at 1 min interval for 15 min period)
  Periodic (In OR mode at 2, 2.5, 5, 10, 15, 30 min interval)
  (In ICU mode at 2, 2.5, 5, 10, 15, 30 min, 1, 2, 4, 8 h interval)
  PWTT trigger available, PWTT threshold 1 to 30 ms
- NIBP data display update cycle: Updated every measurement
- Measurement end sound: Generated when measurement ends (Set on the System Setup screen)
- Alarm (Systolic, Diastolic, Mean)

  Upper limit range: 22 to 250 mmHg (3.0 to 33.3 kPa) in 2 mmHg (0.1 kPa) steps, Off
  Lower limit range: Off, 20 to 248 mmHg (2.8 to 33.1 kPa) in 2 mmHg (0.1 kPa) steps

Multi Amplifiers

Measuring parameters: IBP, Temp, CO, Resp (thermistor), FiO_2, CO_2 (mainstream)
Input impedance: 1 MΩ
Exciter output impedance: less than 1Ω
Exciter current limiter: less than 100 mA
Maximum leakage current from +5 V DC connector: less than 100 mA

Invasive Blood Pressure, IBP

- Measuring range: −50 to 300 mmHg (−6.6 to 40 kPa)
- Measuring accuracy ±1% ±1 mmHg
- Input sensitivity: 5 µV/V/mmHg
- Input impedance: 1 MΩ
- Excitor voltage: 4 VDC
- Transducer impedance: 200 Ω to 20 kΩ
- Auto zero balancing range: ±200 mmHg
- Auto zero balancing accuracy: ±1 mmHg
- Pulse rate counting range: 30 to 300 beats/min
- Pulse rate counting accuracy: ±1 beat/min
- Noise: ≤ 0.25 mmHg
- Temperature zero drift: ±0.1 mmHg/°C
- Frequency response: DC to 10/20 Hz, set on the main unit (Digital filter processing by software)
- Blood pressure display range: −50 to 300 mmHg (−6.6 to 40 kPa)

- Display update cycle: Every 3 s or when alarm is generated
- BP tone: Provided, systolic value 20 to 120 mmHg, changes in 20 steps every 5 mmHg
- Alarm (Systolic, Diastolic, Mean)

Upper limit range:	2 to 300 mmHg (0.4 to 40.0 kPa) in 2 mmHg (0.1 kPa) steps, Off
Lower limit range:	Off, 0 to 298 mmHg (0.1 to 39.7 kPa) in 2 mmHg (0.1 kPa) steps

Temperature

- Measuring range: 0 to 45°C (32 to 113°F)
- Measuring accuracy

Sensor:	±0.1°C
Module:	±0.1°C (25 to 45°C, 77 to 113°F) ±0.2°C (Other range)

- Noise: ≤ 0.014°C at 37°C (99°F)
- Temperature drift: ±0.005°C/°C
- Temperature display

Display range:	0 to 45°C (32 to 113°F)
Display update cycle:	Every 3 s

- Alarm

Upper limit range:	0.1 to 45°C (33 to 113°F) in 0.1°C (0.1°F) steps, Off
Lower limit range:	Off, 0 to 44.9°C (32 to 112°F) in 0.1°C (0.1°F) steps

Cardiac Output, CO

- Measuring method: Thermodilution method
- Measuring range

Injectate temperature (Ti):	0 to 27°C (32 to 81°F)
Blood temperature (Tb):	15 to 45°C (59 to 113°F)
Thermodilution curve (Δ Tb):	0 to 2.5°C (32 to 36.5°F)
Cardiac output (CO):	0.5 to 20 L/min

- Measuring accuracy (catheter sensor accuracy is not included)

Ti:	±0.1°C
Tb 25 to 45°C:	±0.1°C
Tb 15 to 25°C:	±0.2°C
CO:	±5%

- Noise

Ti:	≤ 0.025°C
Tb:	≤ 0.016°C at 37°C (99°F)
ΔTb:	≤ 0.005°C at 37°C (99°F)

- Temperature drift

Ti:	±0.005°C/°C
Tb:	±0.005°C/°C

- Frequency response (ΔTb): 0 to 3 Hz (Digital filter processed by software)
- Catheter size: 5F, 5.5F, 6F, 7F, 7.5F or 8F

- Injectate volume range: 3, 5, 10 cc
- Cardiac output display
  - CO value display range: 0.5 to 20.0 L/min
  - CO value display update cycle: Every measurement
  - Thermodilution curve sweep speed: 1 mm/s
  - Thermodilution curve display time: 45 s
- Alarm limits
  - CO: None
  - Blood temperature (Tb): Same as temperature

Respiration (Thermistor probe pneumography)

- Respiration rate counting range: 0 to 150 breaths/min
- Accuracy: ±1 breath/min
- Temperature measuring range: 10 to 40°C (50 to 104°F)
- Maximum detection resistance range: 1 kΩ
- Recorder sensitivity: Δ100 Ω/400 digits ±10%

  (400 digits is equivalent to 1 cm on paper at ×1 recorder sensitivity)
- Noise: ≤1.0 Ω (referred to input)
- Frequency response: 0.1 to 3 Hz (Digital filter processed by software)
- Waveform display
  - Display sensitivity: 10 mm/100 Ω (at ×1 sensitivity)
  - Sensitivity control: ×1/8, ×1/4, ×1/2, ×1, ×2, ×4, ×8 or Auto
- Respiration rate display update cycle: Every 3 s or when alarm is generated
- Alarm
  - Upper limit range: 2 to 150 breaths/min in 2 breaths/min steps, Off
  - Lower limit range: Off, 0 to 148 breaths/min in 2 breaths/min steps
  - Apnea time: 5 to 40 s in 5 s steps, Off

Inspired Oxygen Fractional Concentration, FiO_2

- Measuring range: 10 to 100% O_2 in 1% steps
- Amplifier accuracy: ±1% full scale
- Accuracy including sensor
  - 21% O_2 calibration: ±3% full scale
  - 100% O_2 calibration: ±2% full scale
- Noise: ≤ 0.12% O_2
- Temperature drift: ±0.12% O_2/°C
- FiO_2 display update cycle: Every 3 s or when alarm is generated
- Alarm
  - Lower limit range: Off, 18 to 100% in 1% steps

Expired Carbon Dioxide Tension, CO_2

When monitoring CO_2 (sidestream) using an AG-900PA CO_2 module, refer to the AG-900PA CO_2 module operator's manual. For the TG-900P/TG-920P/TG-950P CO_2 sensor kit specifications, refer to the kit manual.

- Measurement method: Mainstream (TG-900P/TG-920P: semi quantitative, TG-950P: quantitative)
- Measuring range: 0 to 100 mmHg (0 to 13.3 kPa)
- CO_2 measuring accuracy:

  TG-900P/TG-920P:
  0 to 40 mmHg: ±4 mmHg
  41 to 76 mmHg: ±10% reading
  77 to 100 mmHg: ±12% reading
  (When 1 atmospheric pressure, air inspiration, no condensation)
  O_2 gas effects: Approx. −10% reading (When 100% oxygen is inspired)
  CO_2 gas, N_2O anesthetic gas effects: Effects when 1 mmHg CO_2 gas is inspired, approx. 10% reading. Accuracy in using N_2O anesthetic gas is not guaranteed

  TG-950P:
  0 to 40 mmHg: ±2 mmHg
  41 to 70 mmHg: ±5% reading
  71 to 100 mmHg: ±7% reading
  (When no condensation, BTPS (body temperature 37°C, ambient pressure, saturated with vapor))
- Warm-up time: about 5 s
- Response time:

  TG-900P/TG-920P: 200 ms (typical) for steps from 10 to 90%
  TG-950P: 60 ms (typical) for steps from 10 to 90%, delay time 100 ms ±10 ms
- Detectable respiration rate:

  TG-900P/TG-920P: 3 to 150 breaths/min
  TG-950P: 0 to 150 breaths/min
- Respiration rate counting accuracy: ±2 breaths/min
- CO_2 value display update cycle: Every 3 s or when alarm is generated
- Alarm

  $EtCO_2$ upper limit range: 2 to 99 mmHg (0.4 to 13.2 kPa) in 1 mmHg (0.1 kPa) steps, Off
  $EtCO_2$ lower limit range: Off, 1 to 98 mmHg (0.2 to 13.1 kPa) in 1 mmHg (0.1 kPa) steps
  Apnea time: 5 to 40 s in 5 s steps, Off

ECG/BP Output

- Output impedance

  ECG: 100 Ω
  BP: 100 Ω
- Output waveform

  ECG: ±4.096 V (at 1 mV/V)
  BP: −0.64 to +4.48 V (at 100 mmHg/V)
  Heart rate trigger: Open collector output (Maximum sink current 3 mA, 100 ms pulse amplitude)

- Frequency response

ECG:	DC to ≥35 Hz
BP:	DC to ≥15 Hz

- Sensitivity accuracy

ECG:	±5%
BP:	±1%

- Delay

ECG:	≤ 35 ms (when 10 Hz sine wave is applied to the input)
BP:	≤ 35 ms (when 2 Hz sine wave is applied to the input)
Heart rate trigger:	≤ 100 ms (80 ms when 2 mV peak to peak triangle wave occurs)

Multi Parameter Module, AY-910PA

Same as AY-900PA Multi Parameter Module, except for SpO_2.

SpO_2 and Pulse Wave (Arterial Plethysmographic Waveform)

With Nellcor probe

- Measuring range

SpO_2:	1 to 100% SpO_2 in 1% steps
Pulse rate:	20 to 250 beats/min

- SpO_2 accuracy

Differs according to the probe. Refer to Part II, Section 7-2 of the operator's manual.

- SpO_2 display

Display update cycle:	Every 3 s or when alarm is generated
Sync tone modulation:	Changes in 20 steps at 81 to 100% SpO_2

- Alarm

Lower limit range:	Off, 50 to 100% SpO_2 in 1% steps

Recorder Module WS-920PA and Recorder Unit WS-921RA/RJ/RK

- Recorder

Recording method:	Thermal array recording	
Number of channels:	4 channels (maximum)	
Maximum recording width:	≥ 45 mm	
Paper speed:	5, 25 or 50 mm/s, ±2%	
Recording paper:	FQW50-3-100	
Resolution:	Amplitude direction of waveforms	8 dot/mm
	Tracking direction	40 dot/mm (at 25 mm/s), 20 dot/mm (at 50 mm/s)

BIS Module, AE-900PA

- EEG

Epoch duration:	2 s
Artifact rejection:	Automatic
EEG sensitivity:	10 mm/50 µVp-p ±10%

Measuring parameters:	Bispectral Index, 95% Spectral Edge Frequency, Suppression Ratio, EMG, Signal Quality Index
Displayed items:	Trendgraph, DSA, CSA, real-time EEG
Filters:	ON: 2 to 70 Hz (–3 dB ±20%) OFF: 0.25 to 100 Hz (–3 dB ±20%)
AC filter:	OFF, 50/60 Hz (decrement rate –20 dB)

- Digital Signal Converter

Model:	DSC-3
Input impedance:	>50 mΩ
Noise:	<0.3 µVrms

EEG Module, AE-910PA

- EEG

Number of channels:	2
Non distorted maximum input:	>±3 mV
Polarization voltage:	>±700 mV
Noise:	<3 µVp-p
Input impedance:	>15 MΩ at 10 Hz
CMRR:	>110 dB
Electrode impedance check:	>10 kΩ within ±20%
EEG sensitivity:	10 µV/mm within ±5%
Filters:	High-cut: 70 Hz at 70% amplitude (–3 dB) within ±20% Low-cut: 2 s ±20% or 0.05 Hz 70% amplitude (–3 dB) within ±20%
AC filter:	>26 dB

FLOW/Paw Module, AF-900PA

- Display

Display waveforms:	Paw, FLOW and VOL
Numerical data display:	Ppeak, PEEP, Pmean, RR (FLOW), MV, TV, inTV and Ti/Ttot

- Performance

Flow

Measuring range:	–3.0 to +3.0 (L/s)
Measuring accuracy:	±0.025 L/s ±5% reading

Paw

Measuring range:	–150 to +150 (cmH_2O)
Measuring accuracy:	±0.5 cmH_2O ±5% reading

$S\bar{v}O_2$ Module, AL-910PA

Operating range:	30 to 97%
Bench accuracy:	Pooled in-vivo data will have a mean error at 0% and a maximum standard deviation error at 2%
Measuring resolution:	1%

CO_2 Module, AG-900PA

- Measuring range: 0 to 99 mmHg
- Measuring accuracy: 0 to 38 mmHg ±2 mmHg
  39 to 99 mmHg ± [5 + 0.08 × (χ − 38)] % of reading

  χ: CO_2 partial pressure of a standard gas with a known CO_2 partial pressure (mmHg)

  The above measuring accuracy is available only when the following conditions are met.
  - More than 20 minutes have passed after the power on and the warm up of the module.
  - When using under the specified environment condition.
  - When CO_2 calibration is performed properly.
  - When coexisting gases are within the following ranges.

    N_2: 0 to 99%
    O_2: 0 to 80%
    N_2O: 0 to 80%
    H_2O: dry to saturated humidity
    Anesthetic agents: Halothane: 0 to 6.5%
    Isoflurane: 0 to 6.5%
    Enflurane: 0 to 6.5%
    Desflurane: 0 to 24%
    Sevoflurane: 0 to 9%
- Measuring resolution: 1 mmHg
- Rising time: Within 500 ms (Including airway adaptor, sampling tube and FilterLine)
- Noise: Less than ±1 mmHg or ±2% of reading
- Safety (Sensitivity drift): Less than ±3% of reading/24 h
- Respiratory rate measuring range: 0 to 150 resp/min
- Respiratory rate measuring accuracy: 0 to 40 resp/min, ±1 resp/min
  41 to 70 resp/min, ±2 resp/min
  71 to 100 resp/min, ±3%
  101 to 150 resp/min, ±5%
- Sampling flow: 50 ±7.5 mL/min
- Warming up time: From power on to the measurable state (Self test and initialization time): 20 s (typical), 120 s maximum
  From the measurable state to the state which satisfies the specification: within 20 min
- Dehumidifying performance: Can be used for more than 72 h continuously (When using the YG-911P FilterLine)

Multi Gas Unit, AG-910RA/RK

- Measurement and identified gases: CO_2, N_2O, O_2, Halothane, Isoflurane, Enflurane, Sevoflurane, Desflurane
  When there are more than one of the above anesthetic agents, “MIXED GAS” is displayed on the screen.
- Measurement method: Non-dispersive infrared CO_2, N_2O, Halothane, Isoflurane, Enflurane, Sevoflurane and Desflurane

Paramagnetic O_2

- Sample delivery rate: 120 or 200 ml/min (selectable)
- Measurement range:

CO_2	0 to 80 mmHg
N_2O	0 to 100%
O_2	0 to 100%
Halothane	0 to 7.5%
Isoflurane	0 to 7.5%
Enflurane	0 to 7.5%
Sevoflurane	0 to 9.0%
Desflurane	0 to 20.0%

- Measurement accuracy

NOTE

When alcohol or acetone is present in the patient expiration, the instrument gives inaccurate gas analysis data.

CO_2	0 to 40.0 mmHg, ±1.5 mm Hg
	40.1 to 60.0 mmHg, ±2.5 mmHg
	60.1 to 80 mmHg: ±4.0 mmHg
N_2O	±(1.5% abs. + 5.0% rel.)
O_2	±(2.5% abs. + 5.0% rel.).
Halothane	±(0.2% abs. + 4.0% rel.)
Isoflurane	±(0.1% abs. + 4.0% rel.)
Enflurane	±(0.1% abs. + 4.0% rel.)
Sevoflurane	±(0.1% abs. + 4.0% rel.)
Desflurane	±(0.1% abs. + 6.0% rel.)

- Agent Identification sensitivity (Maximum agent concentration required for identification)

Halothane	0.20% Halothane abs.
Isoflurane	0.20% Isoflurane abs.
Enflurane	0.20% Enflurane abs.
Sevoflurane	0.20% Sevoflurane abs.
Desflurane	0.25% Desflurane abs.

- Agent detection time: 11 seconds maximum at 200 ml/min
- Response time (10 to 90% at 200 ml/min)

CO_2	<350 ms
N_2O	<400 ms
O_2	<300 ms
Halothane	<500 ms
Isoflurane	<500 ms
Enflurane	<500 ms
Sevoflurane	<500 ms
Desflurane	<500 ms

- Respiration rate: Range 0 to 90 rpm
- Respiration rate accuracy: 2 to 60 rpm, ±2 rpm
- Warm-up time: 2 minutes to first measurement

  8 minutes to accuracy measurement

Multigas Unit, AG-920RA/RK

- Measured gases: CO_2 partial pressure, N_2O concentration, O_2 concentration, anesthetic agent concentration (Halothane, Isoflurane, Enflurane, Sevoflurane, Desflurane), respiration rate
- Warm-up time: 45 s to first measurement
  10 min to measurement with guaranteed accuracy
- Sampling rate: 70 to 200 mL/min (selectable)
- CO_2 measurement:
  - Measurement method: Non-dispersive infrared ray absorption
  - Measuring range: 0 to 76 mmHg
  - Measuring accuracy: ±2 mmHg (0 to 40.0 mmHg)
    ±3 mmHg (40.1 to 55.0 mmHg)
    ±4 mmHg (55.1 to 76 mmHg)
  - Response time: within 250 ms (10 to 90%)
- N_2O measurement:
  - Measurement method: Non-dispersive infrared ray absorption
  - Measuring range: 0 to 100%
  - Measuring accuracy: ±3%
  - Response time: within 250 ms (10 to 90%)
- O_2 measurement:
  - Measurement method: Paramagnetic
  - Measuring range: 0 to 100%
  - Measuring accuracy: ±2% (0 to 55%)
    ±3% (55 to 100%)
  - Response time: within 500 ms (10 to 90%)
- Anesthetic measurement:
  - Measurement method: Non-dispersive infrared ray absorption
  - Measuring range: Halothane 0 to 5%
    Isoflurane 0 to 5%
    Enflurane 0 to 5%
    Sevoflurane 0 to 8%
    Desflurane 0 to 15%
  - Measuring accuracy: ±0.2% (0 to 5%)
    ±0.4% (5 to 10%)
    ±0.6% (10 to 15%)

NOTE

When alcohol or acetone is present in the patient expiration, the unit gives inaccurate gas analysis data.

  - Response time: within 300 ms (10 to 90%) (Halothane, Isoflurane, Sevoflurane, Desflurane)
    within 500 ms (10 to 90%) (Enflurane)
- Respiration rate
  - Measuring range: 4 to 60 breaths/min
  - Measuring accuracy: ±1 breath/min

CCO Unit, AH-900RA/RJ/RK

- Measuring parameters: CCO, CO and $S\bar{v}O_2$
- Operating range: CCO: 1 to 20 L/min
  - CO: 1 to 20 L/min
  - Tb: 17.5 to 45°C
  - $S\bar{v}O_2$: 30 to 97%
- Bench accuracy: CCO: ≤±10% at steady state
  - CO: ±10% for 95% confidence
  - $S\bar{v}O_2$: Pooled in-vivo data will have a mean error at 0% and a maximum standard deviation error at 2%

Interface, QI-910RA/RJ/RK

- Analog Input: Number of channels: 8 channels
  - AD conversion: 12 bit
- ECG Input: Input sensitivity: 1 V/mV ±1% (monitor input conversion)
  - Frequency response: DC to 100 Hz
  - Maximum input voltage: ±5 V
- Blood Pressure (Systolic)
  - Input sensitivity: 1 V/100 mmHg ±1% (monitor input conversion)
  - Frequency response: DC to 40 Hz
  - Maximum input voltage: –0.5 V to 3 V (–50 mmHg to 300 mmHg)
  - Offset error: less than 5 mV (0.5 mmHg)
- Blood Pressure (Diastolic)
  - Input sensitivity: 1 V/20 mmHg ±1% (monitor input conversion)
  - Frequency response: DC to 40 Hz
  - Maximum input voltage: –0.5 V to 3 V (–50 mmHg to 300 mmHg)
  - Offset error: less than 5 mV (0.1 mmHg)
- Respiration waveform
  - Input sensitivity: 1 V/Ω ±1%
  - Frequency response: DC to 40 Hz
  - Maximum input voltage: ±5 V
- Pulse waveform
  - Input sensitivity: 1 V/Ω ±1%
  - Frequency response: DC to 40 Hz
  - Maximum input voltage: ±5 V
- EEG waveform: Input sensitivity: 1 V/50 µV ±1%
  - Frequency response: DC to 40 Hz
  - Maximum input voltage: ±5 V
- CO_2 wave Input sensitivity: 1 V/20 mmHg ±1%
  - Frequency response: DC to 40 Hz
  - Maximum input voltage: –0.5 V to 3 V (–10 mmHg to 60 mmHg)
  - Offset error: less than 5 mV (0.1 mmHg)

- Digital Communication

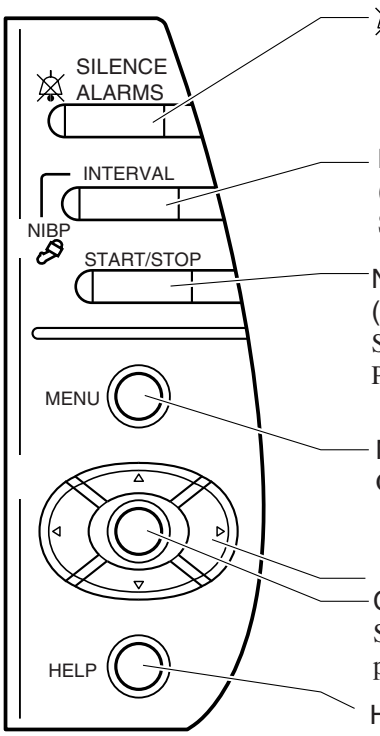
Communication method:	Full duplex serial communication	
Baud rate:	9600 bps	
Sync method:	Start-stop synchronization	
Data format:	Data length	8 bit
	Parity	odd
	Stop bit	2 bit
Flow control:	Hardware	
Physical layer:	RS485 reference	

- Heart rate sync signal

Open collector:	Low active (requires optional software for analysis)

Names and Function of Parts

Control Panel



SILENCE ALARMS key
Silences the alarm sound.

NIBP INTERVAL key
(Only for the bedside monitor)
Selects NIBP measurement mode. Pressing this key changes the mode.

NIBP START/STOP key
(Only for the bedside monitor)
Starts NIBP measurement in the selected mode.
Pressing the key during measurement stops measurement.

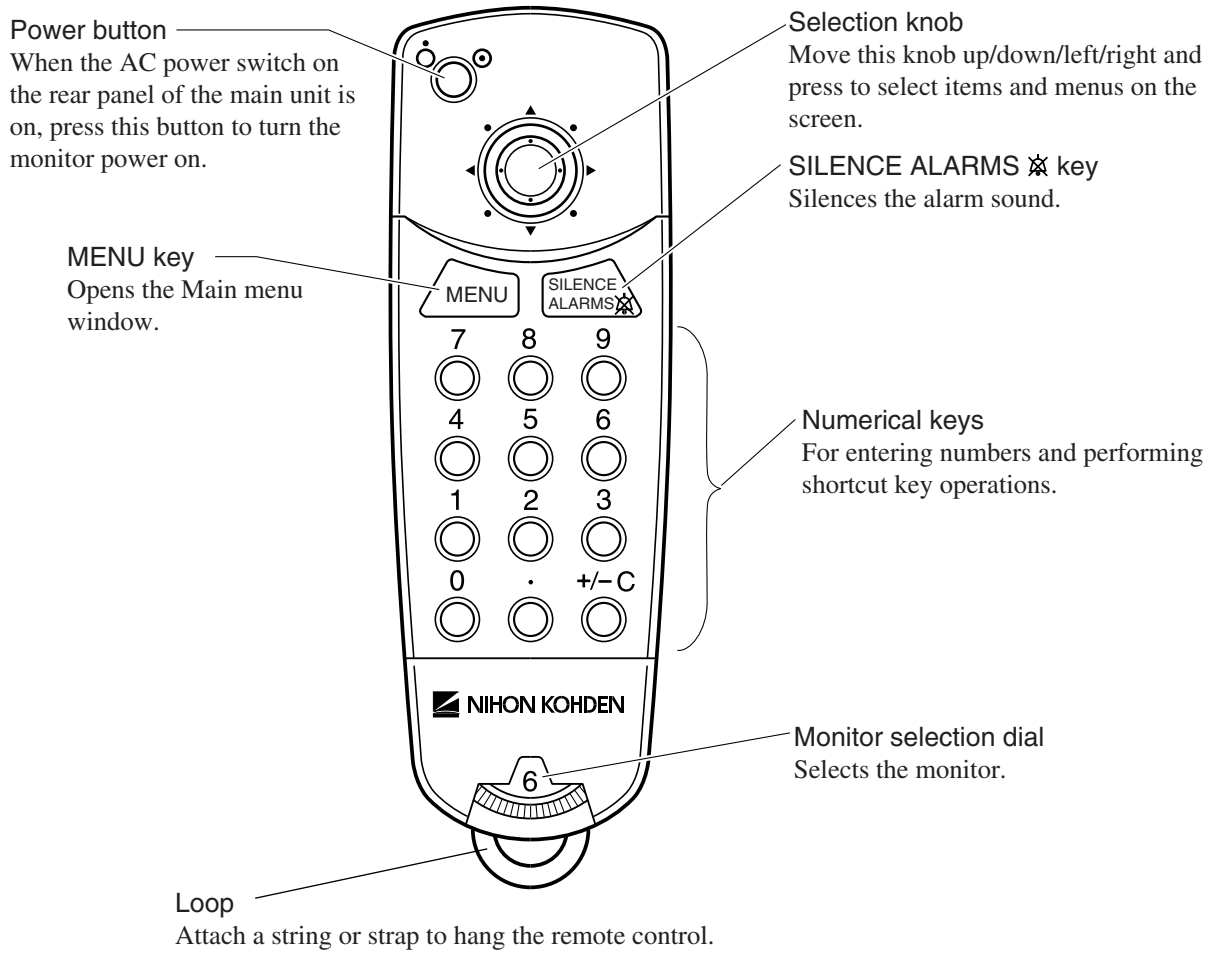
MENU key
Opens the Main menu window.

△,▽, ◁,▷ keys
Center key
Selects the items and menus on the screen and performs various operations.

HELP key
Displays help on the screen.

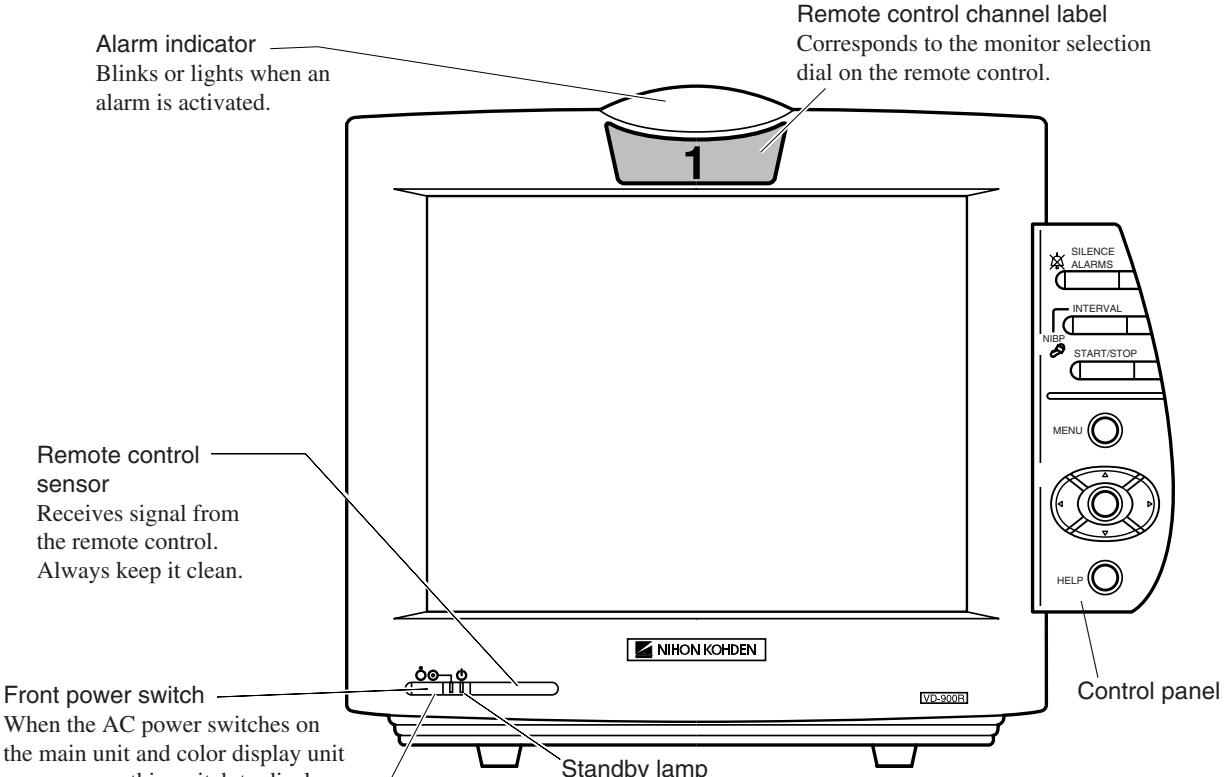
When the NIBP Key on the System Setup screen is set to STAT, the NIBP INTERVAL key can be used as the STAT START/STOP key. Refer to “List and Explanation of System Setup Settings” in Part I, Section 4 and “Measurement Mode and Interval” in Part II, Section 8 of the BSS-9800 operator’s manual.

Remote Control

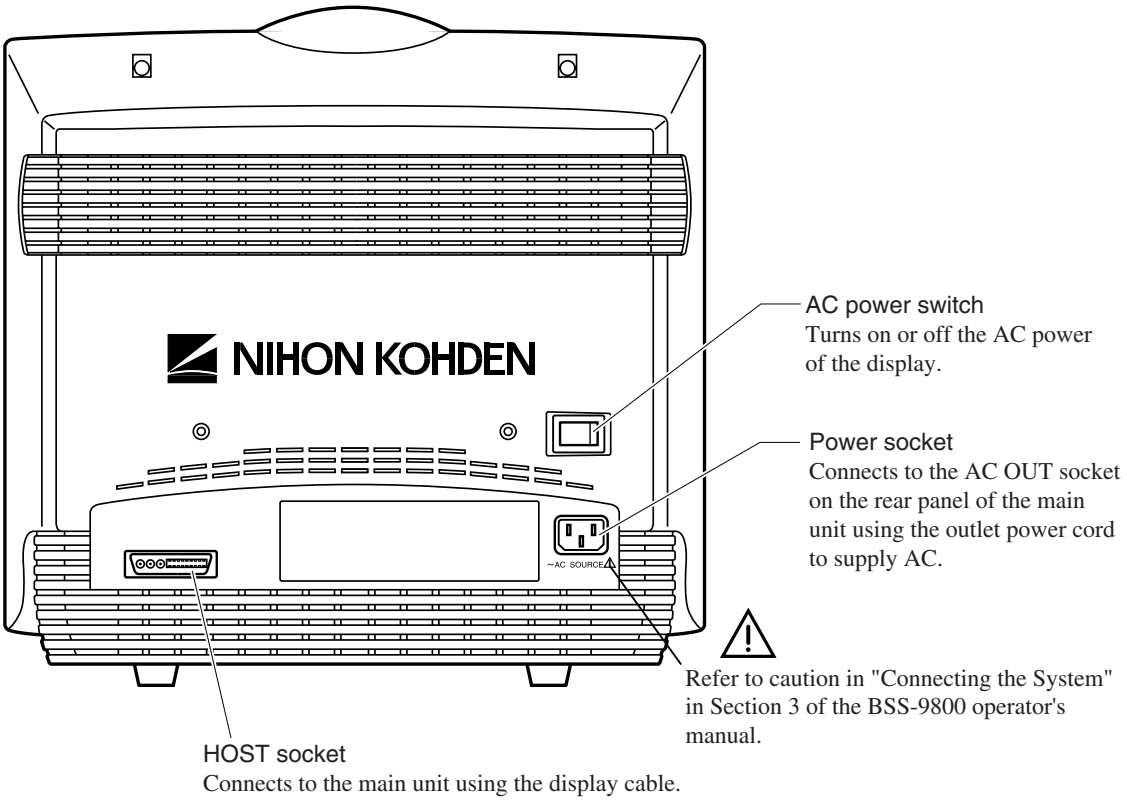

Power button
When the AC power switch on the rear panel of the main unit is on, press this button to turn the monitor power on.
Selection knob
Move this knob up/down/left/right and press to select items and menus on the screen.
SILENCE ALARMS key
Silences the alarm sound.
MENU key
Opens the Main menu window.
MENU
SILENCE ALARMS
7 8 9
4 5 6
1 2 3
0 . +/− C
Numerical keys
For entering numbers and performing shortcut key operations.
NIHON KOHDEN
Monitor selection dial
Selects the monitor.
6
Loop
Attach a string or strap to hang the remote control.

Color Display Unit

Front Panel

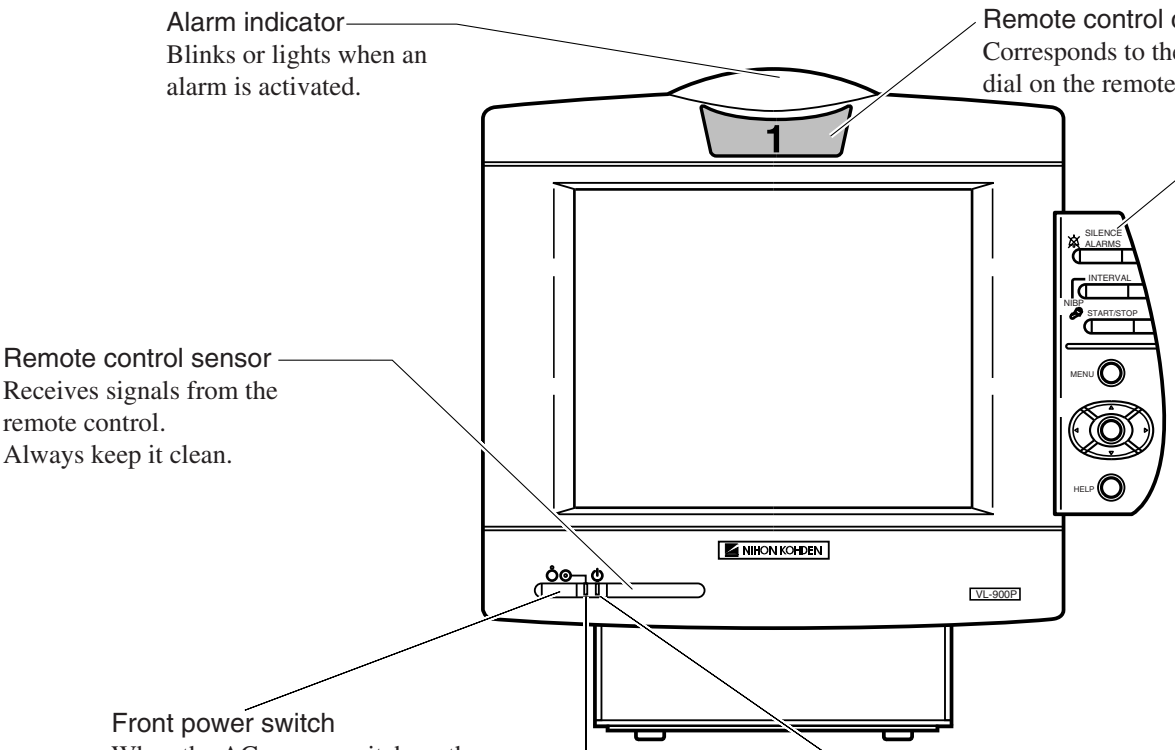

Alarm indicator
Blinks or lights when an alarm is activated.
Remote control channel label
Corresponds to the monitor selection dial on the remote control.
1
SILENCE ALARMS
INTERVAL
NIBP
START/STOP
MENU
HELP
Remote control sensor
Receives signal from the remote control.
Always keep it clean.
NIHON KOHDEN
VD-900R
Control panel
Front power switch
When the AC power switches on the main unit and color display unit are on, press this switch to display waveforms and data.
Standby lamp
Lights when the AC power switch on the color display unit is on.
Power lamp
Lights when the AC power switches on the main unit and color display unit and the front power switch on the color display unit are on.

Rear Panel

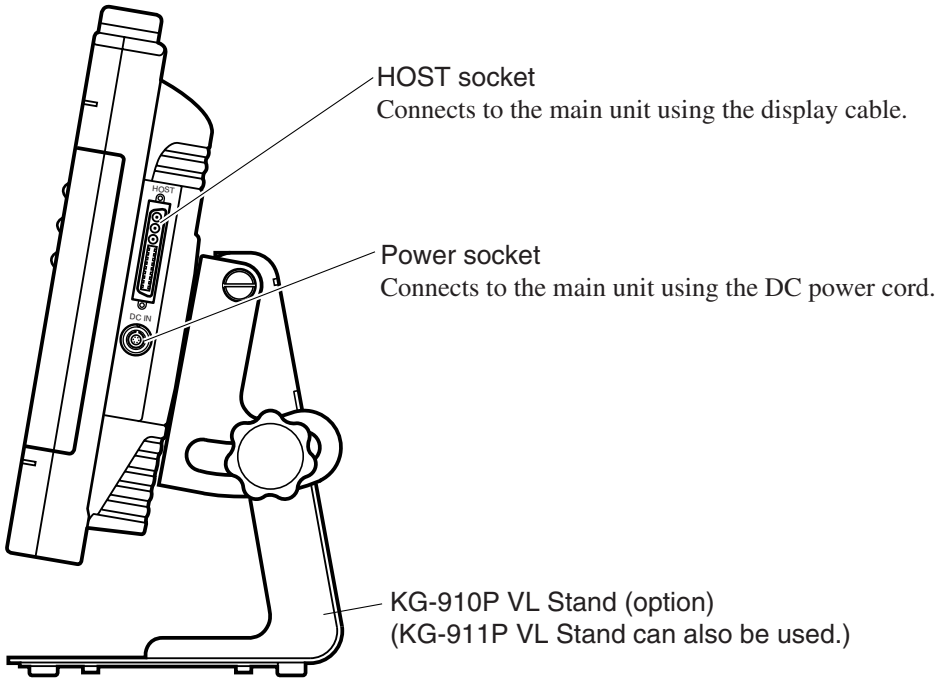

NIHON KOHDEN
~AC SOURCE
AC power switch
Turns on or off the AC power of the display.
Power socket
Connects to the AC OUT socket on the rear panel of the main unit using the outlet power cord to supply AC.
Refer to caution in "Connecting the System" in Section 3 of the BSS-9800 operator's manual.
HOST socket
Connects to the main unit using the display cable.

Color LCD Unit (VL-900PA)

Front panel

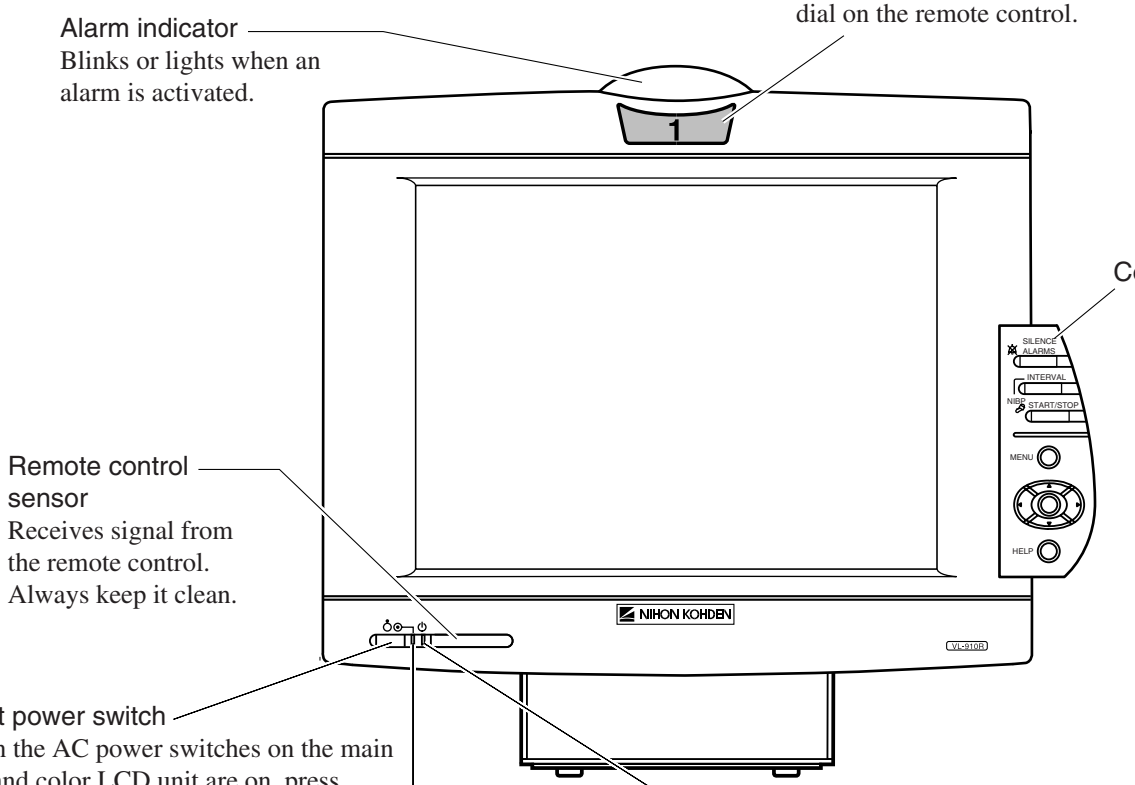

Alarm indicator
Blinks or lights when an alarm is activated.
Remote control channel label
Corresponds to the monitor selection dial on the remote control.
Control panel
Remote control sensor
Receives signals from the remote control.
Always keep it clean.
Front power switch
When the AC power switch on the main unit is on, press this switch to display waveforms and data.
Power lamp
Lights when the AC power switch on the main unit and the front power switch on the color LCD unit are on.
Standby lamp
Lights when the AC power switch on the main unit is on.
1
SILENCE ALARMS
INTERVAL
NIBP
START/STOP
MENU
HELP
NIHON KOHDEN
VL-900P

Right Side Panel

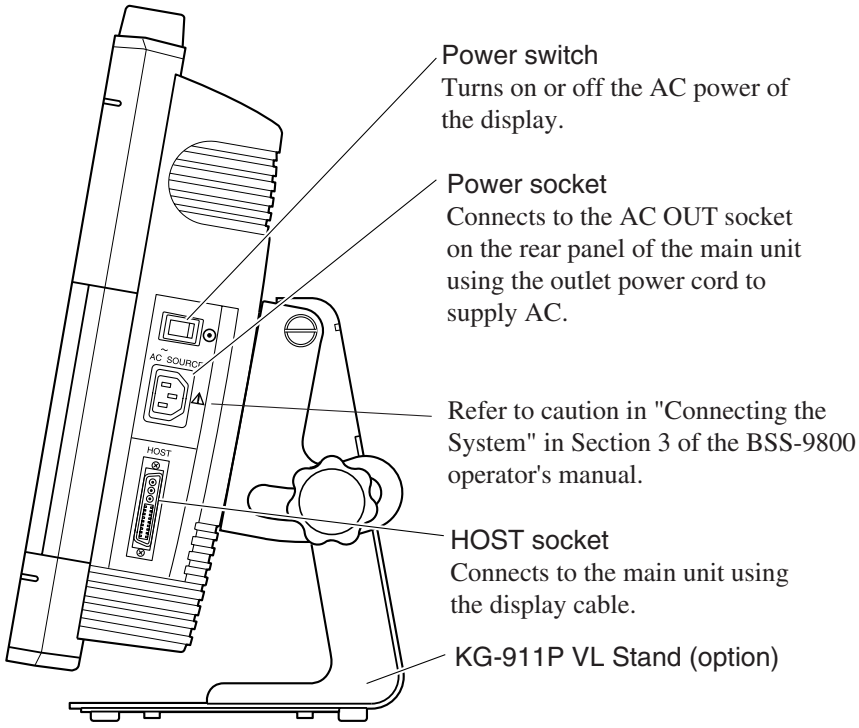

HOST socket
Connects to the main unit using the display cable.
Power socket
Connects to the main unit using the DC power cord.
KG-910P VL Stand (option)
(KG-911P VL Stand can also be used.)
HOST
DC IN

Color LCD Unit (VL-910RA)

Front panel


Remote control channel label
Corresponds to the monitor selection dial on the remote control.
Alarm indicator
Blinks or lights when an alarm is activated.
Control panel
SILENCE ALARMS
INTERVAL
NIBP START/STOP
MENU
HELP
NIHON KOHDEN
VL-910R
Remote control sensor
Receives signal from the remote control. Always keep it clean.
Front power switch
When the AC power switches on the main unit and color LCD unit are on, press this switch to display waveforms and data.
Power lamp
Lights when the AC power switches on the main unit and color LCD unit and the front power switch on the color LCD unit are on.
Standby lamp
Lights when the AC power switch on the color LCD unit is on.

Right Side Panel

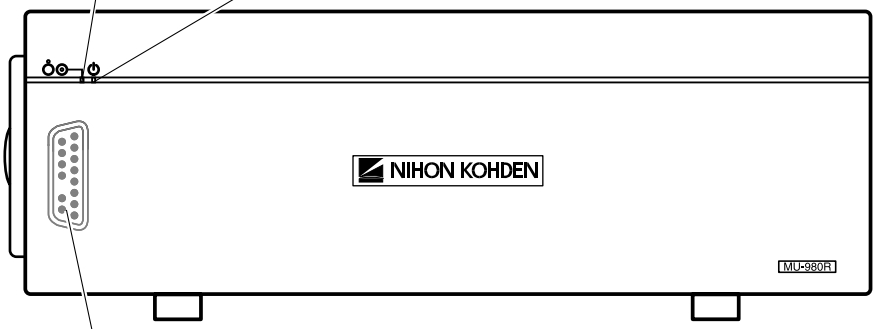

Power switch
Turns on or off the AC power of the display.
Power socket
Connects to the AC OUT socket on the rear panel of the main unit using the outlet power cord to supply AC.
AC SOURCE
Refer to caution in "Connecting the System" in Section 3 of the BSS-9800 operator's manual.
HOST
HOST socket
Connects to the main unit using the display cable.
KG-911P VL Stand (option)

Main Unit

Front Panel

Power lamp
Lights when the AC power switches on the main unit and color display unit and the front power switch on the display unit are on.

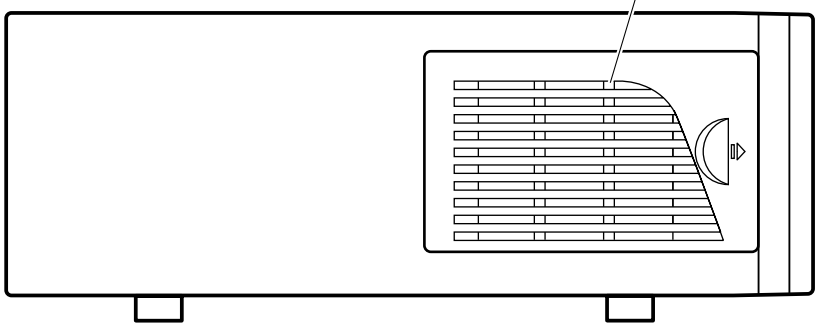
Standby lamp
Lights when the AC power switch on the main unit is on.



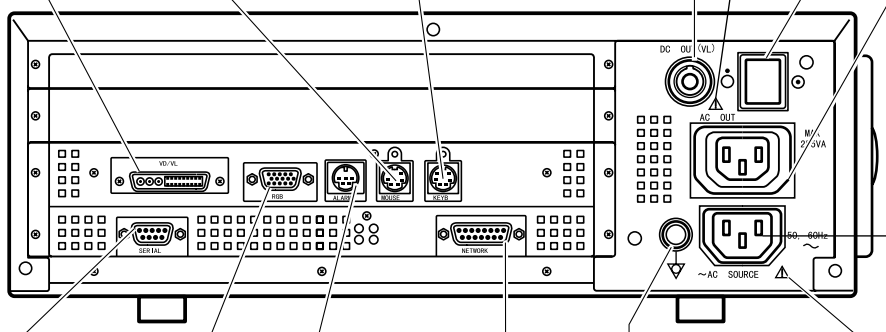
JA socket
Connects to the input box and unit using the JA connection cable.
The front cover must be removed.

Side Panel

Vent hole
For cooling air.
Change or replace the filter when the "CHANGE FILTER" message appears on the screen.



Rear Panel



DC OUT (VL) socket
Connects to the VL-900PA color LCD unit or RY-900P display connection box using the DC power cord.

NOTE
Do not connect other equipment.

⚠ Refer to cautions in "Connecting the System" and "Connecting the Power Cord and Grounding the Monitor" in Section 3 of the BSS-9800 operator's manual.

VD/VL socket
Connects to the color display unit or color LCD unit using the display cable.

KEYB socket
Connects to the optional keyboard.

MOUSE socket
Connects to the optional mouse.

AC power switch
Turns on or off the AC power of the main unit.

AC OUT socket
Connects to the VD-900RA/RK color display unit or VL-910RA color LCD unit using the outlet power cord. The output is not linked with the power on/off of the main unit.

NOTE
Do not connect other equipment.

Power socket
Connects to a wall outlet using the power cord to supply AC to the main unit.

⚠ Refer to cautions in "Connecting the Power Cord and Grounding the Monitor" in Section 3 of the BSS-9800 operator's manual.

Equipotential terminal
Connects to the equipotential ground cable.

SERIAL socket*
Connects to a PC.

ALARM socket
Connects to the optional alarm pole.

RGB socket*
Connects to a display.

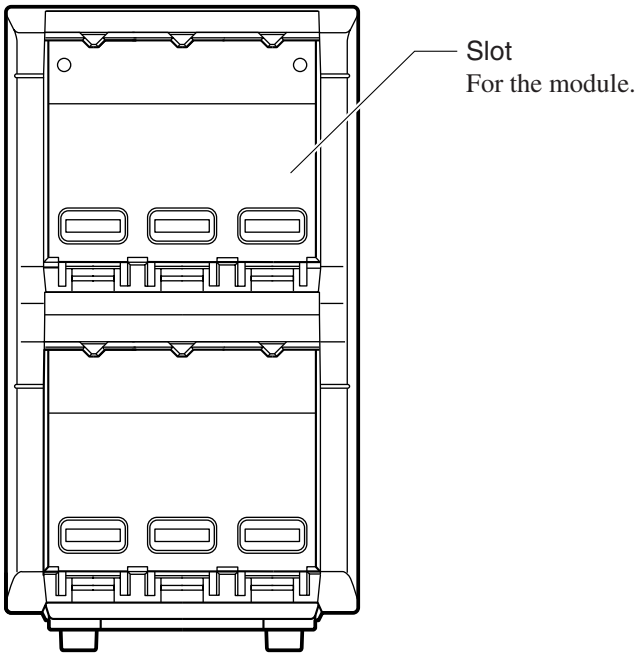
NETWORK socket
Connects to the AUI patch cable of the network.

* Contact your Nihon Kohden distributor when using the SERIAL or RGB socket on the main unit.

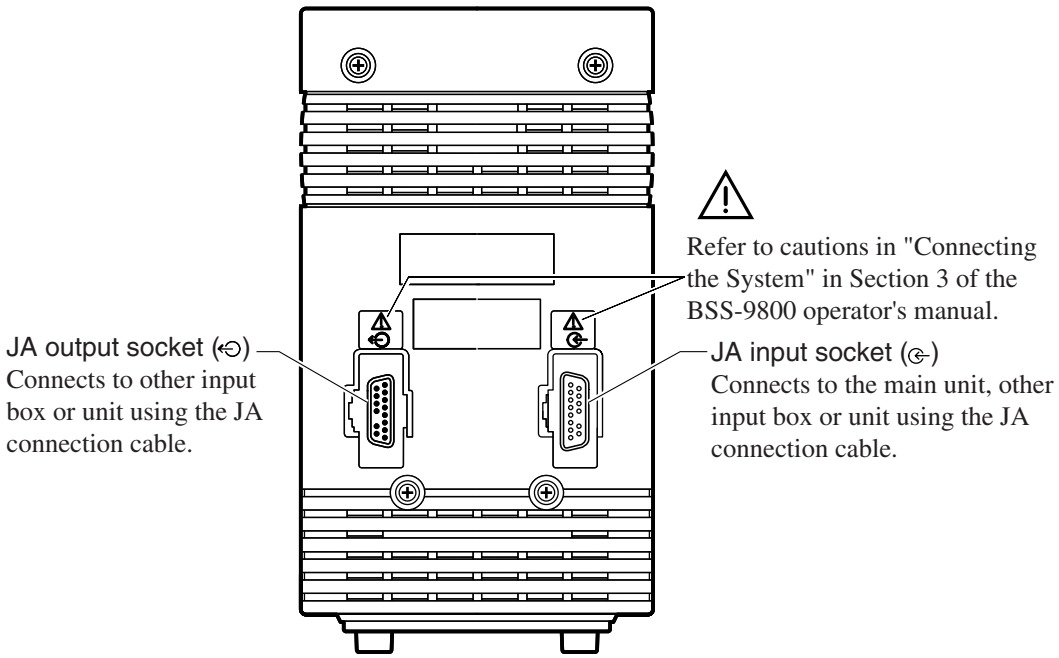
Input Box

A cord hook is provided with the input box for hooking the connection cords. Refer to “Connecting the Main Unit, Input Boxes and Units” in Section 3 of the BSS-9800 operator’s manual.

Front Panel



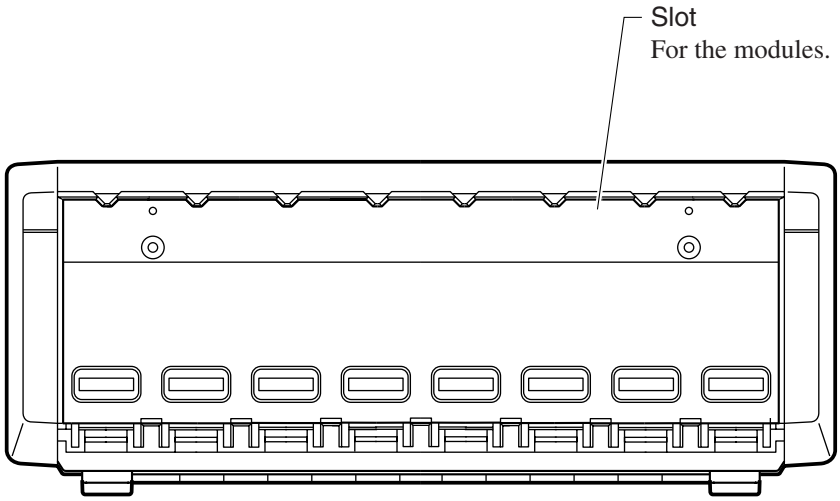
Rear Panel


Refer to cautions in "Connecting the System" in Section 3 of the BSS-9800 operator's manual.
JA output socket (⇦)
Connects to other input box or unit using the JA connection cable.
JA input socket (⇨)
Connects to the main unit, other input box or unit using the JA connection cable.

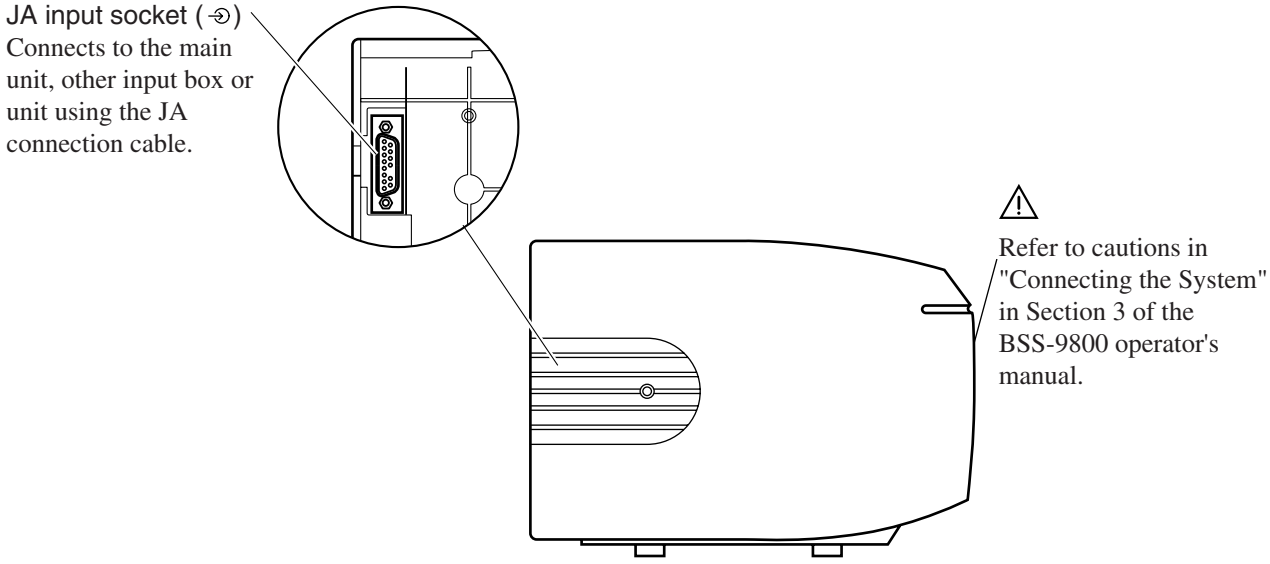
Input Box

A cord hook is provided with the input box for hooking the connection cords. Refer to “Connecting the Main Unit, Input Boxes and Units” in Section 3 of the BSS-9800 operator’s manual.

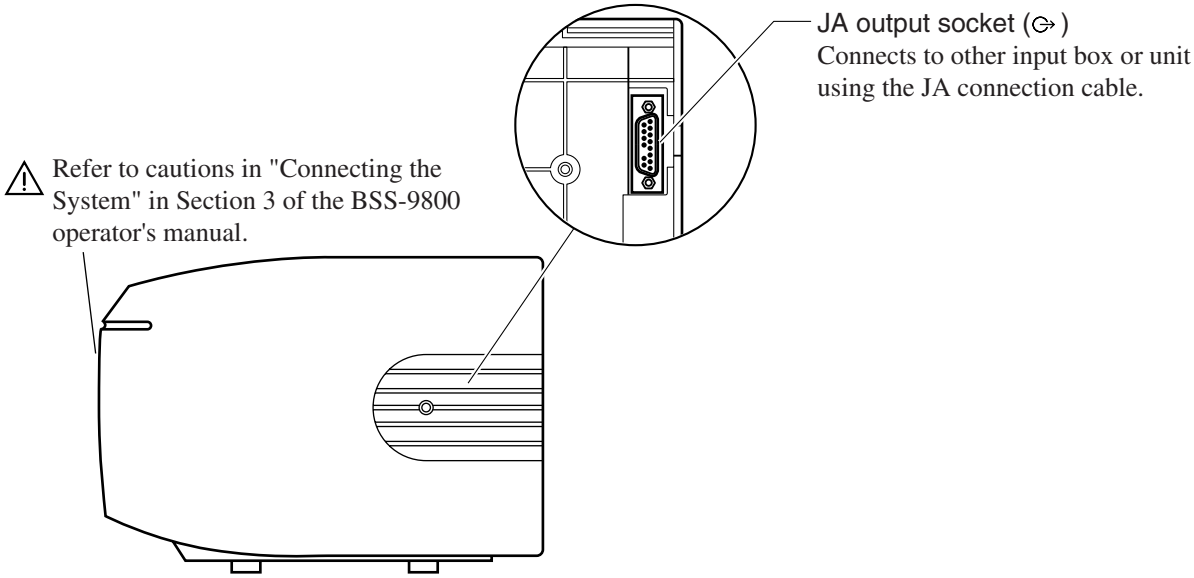
Front Panel



Left Side Panel

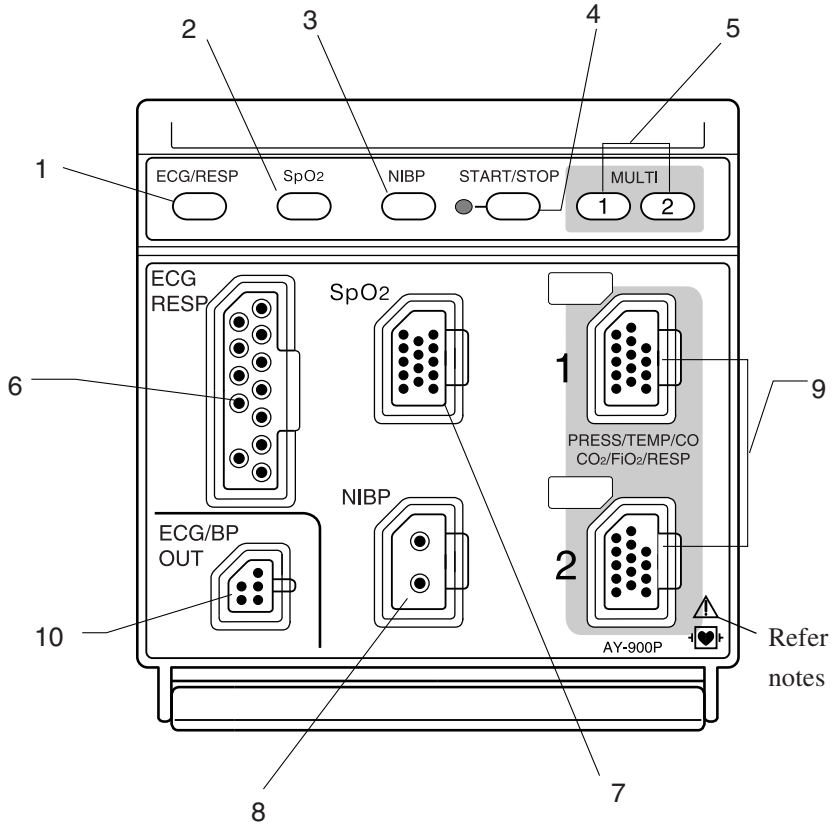

JA input socket ( )
Connects to the main unit, other input box or unit using the JA connection cable.
Refer to cautions in "Connecting the System" in Section 3 of the BSS-9800 operator's manual.

Right Side Panel


JA output socket ( )
Connects to other input box or unit using the JA connection cable.
Refer to cautions in "Connecting the System" in Section 3 of the BSS-9800 operator's manual.

Multi Parameter Module

AY-900PA is for Nihon Kohden SpO_2 probes.
AY-910PA is for Nellcor SpO_2 probes.



No.	Name	Description
1	ECG/RESP key	Press to open the ECG window.
2	SpO_2 key	Press to open the SpO_2 window.
3	NIBP key	Press to open the NIBP window and change the NIBP measurement mode.
4	START/STOP key	Measures the NIBP in the selected mode. Pressing again during measurement stops measurement.
5	MULTI 1, MULTI 2 keys	Press to open the windows of the parameters connected to the MULTI 1 or MULTI 2 socket.
6	ECG RESP socket	Connects to the ECG connection cord.
7	SpO_2 socket	Connects to the SpO_2 connection cord.
8	NIBP socket	Connects to the air hose.
9	MULTI 1, MULTI 2 sockets	Connects to the connection cord of the parameter to be measured (IBP, temperature, CO, CO_2, FiO_2 or respiration by thermistor method). When using the IBP output signal, use the MULTI 1 socket. The type of parameter is automatically recognized.
10	ECG/BP OUT socket	Outputs 100 mmHg/V IBP waveform of the pressure connected to the MULTI 1 socket, 1 mV/V ECG waveform of the first trace and heart rate trigger by using YJ-910P or YJ-920P ECG/BP output cable. These analog signals can be used as the synchronization signal for other equipment, such as IABP. Refer to the warning on the next page.

Using the Output Signal from the ECG/BP OUT Socket

WARNING

When using the output signal from the module as the synchronization signal for other equipment such as IABP (intra-aortic balloon pump) or defibrillator:

- **Set the timing of the other equipment by checking the waveform on the monitoring screen.**
- **Check the condition of the bedside monitor at all times. The output signal may become unstable.**
- **The hum filter is always set to on for the ECG output. ECG output differs from the ECG on the monitor screen regardless of the filter setting.**
- **Check that the delay time of the output signal (heart rate trigger 100 ms maximum) is within the range of the connected equipment. Refer to Part II, Section 5.**
- **Do not use the heart rate trigger as the synchronization signal for a defibrillator.**

NOTE

The output signal from the ECG/BP OUT socket may become unstable in the following conditions.

- **Electrode is dry or detached.**
- **Electrode lead is damaged or disconnected from the electrode.**
- **Electrode lead is pulled.**
- **AC interference or EMG noise superimposed.**
- **Air bubbles or blood clog in the circuit for monitoring IBP.**
- **Any cord or cable disconnected or damaged.**

Using MULTI Sockets for CO and CO_2 Monitoring

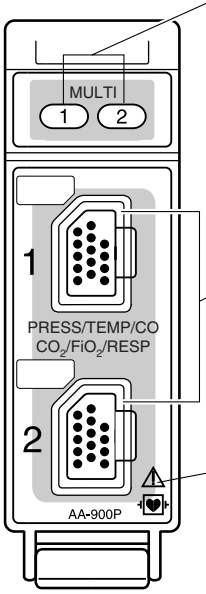
WARNING

- **When performing defibrillation during CO monitoring, never touch the CO connection cord. Otherwise the discharged energy may cause serious electrical burn, shock or other injury.**
- **When performing defibrillation during CO_2 monitoring with the TG-900P CO_2 sensor kit, remove the sensor from the patient. When the sensor cannot be removed, do not touch the sensor cable because the discharged energy may cause serious electrical burn, shock or other injury.**

NOTE

- **CO monitoring using the MULTI socket does not comply with the Defibrillator proof type CF.**
- **CO_2 monitoring using the MULTI socket does not comply with the Defibrillator proof type BF.**

Smart Module



MULTI 1, MULTI 2 key
Press to open the windows of the parameters connected to the MULTI 1 or MULTI 2 socket.

MULTI 1, MULTI 2 Socket
Connects to the connection cord of the parameter to be measured from IBP, temperature, CO, CO_2, FiO_2 and respiration by thermistor method. The type of parameter is automatically recognized.

Refer to warnings and notes below.

Using MULTI Sockets for CO and CO_2 Monitoring

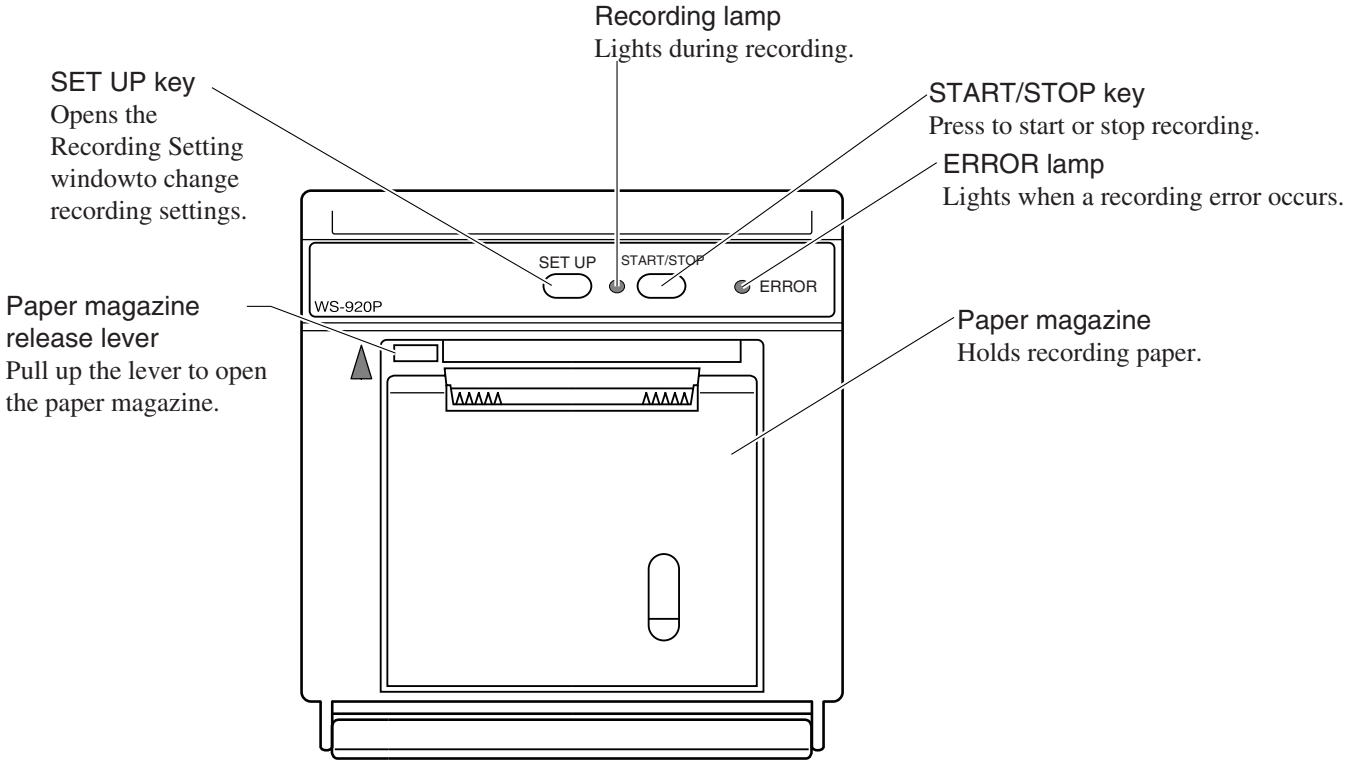
WARNING

- **When performing defibrillation during CO monitoring, never touch the CO connection cord. Otherwise the discharged energy may cause serious electrical burn, shock or other injury.**
- **When performing defibrillation during CO_2 monitoring with the TG-900P CO_2 sensor kit, remove the sensor from the patient. When the sensor cannot be removed, do not touch the sensor cable because the discharged energy may cause serious electrical burn, shock or other injury.**

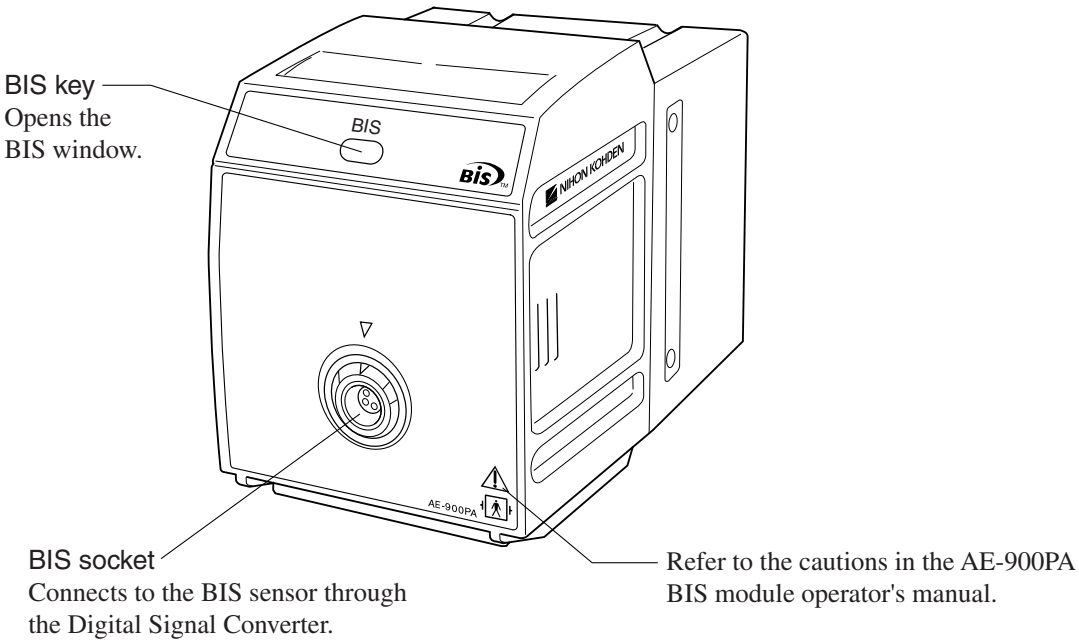
NOTE

- **CO monitoring using the MULTI socket does not comply with the Defibrillator proof type CF.**
- **CO_2 monitoring using the MULTI socket does not comply with the Defibrillator proof type BF.**

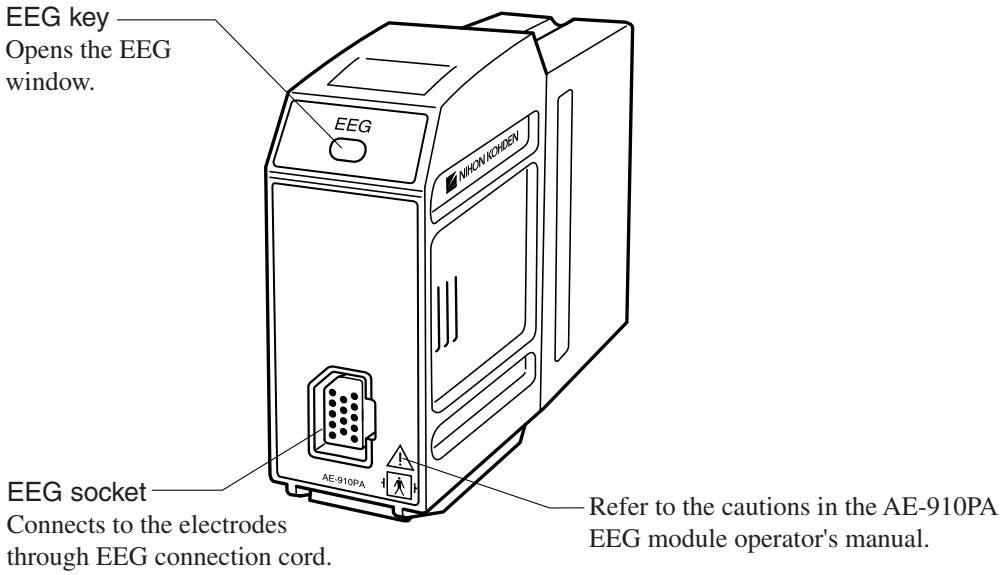
Recorder Module



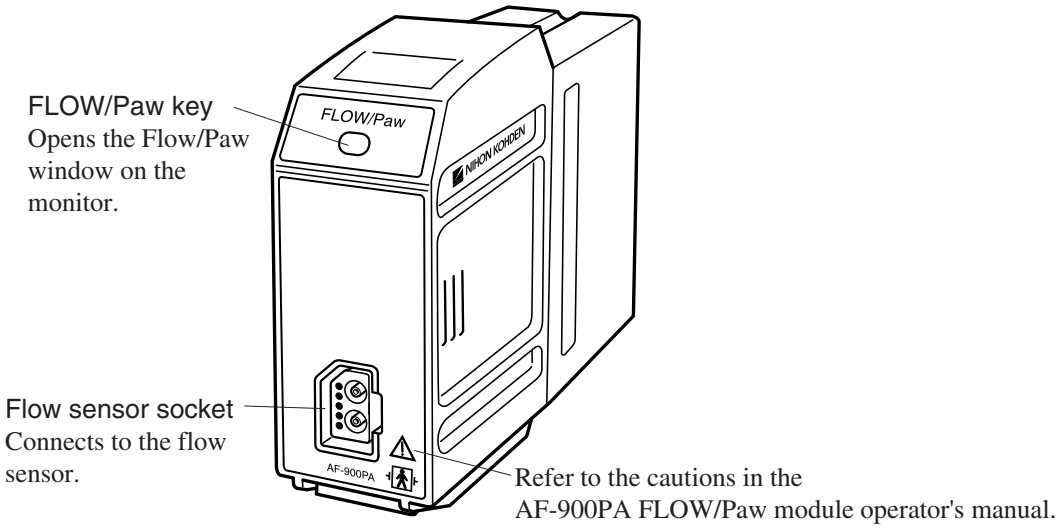
BIS Module


BIS key
Opens the BIS window.
BIS
NIHON KOHDEN
AE-900PA
BIS socket
Connects to the BIS sensor through the Digital Signal Converter.
Refer to the cautions in the AE-900PA BIS module operator's manual.

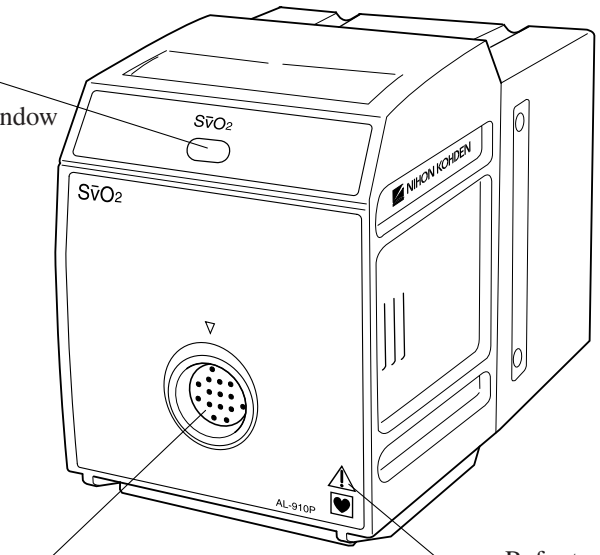
EEG Module



FLOW/Paw Module


FLOW/Paw key
Opens the Flow/Paw window on the monitor.
FLOW/Paw
NIHON KOHDEN
AF-900PA
Flow sensor socket
Connects to the flow sensor.
Refer to the cautions in the AF-900PA FLOW/Paw module operator's manual.

$S\bar{v}O_2$ Module

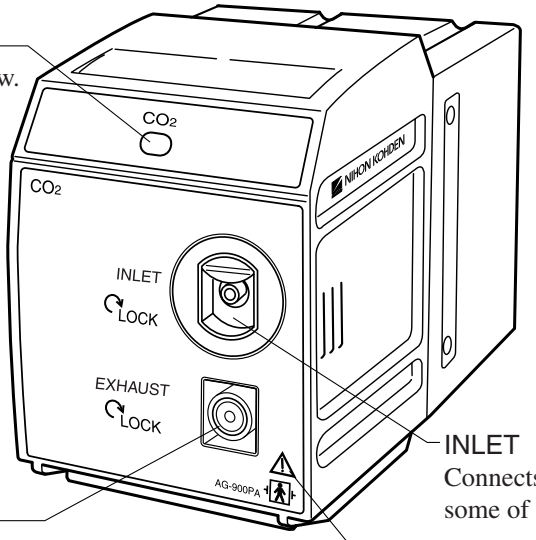


$S\bar{v}O_2$ key
Opens the $S\bar{v}O_2$ window on the monitor.

Refer to the cautions in the AL-910PA $S\bar{v}O_2$ module operator's manual.

$S\bar{v}O_2$ socket
Connects to the optical module.

CO_2 Module



CO_2 key
Opens the CO_2 window.

INLET
Connects to the FilterLine to suck in some of the gas breathed by the patient.

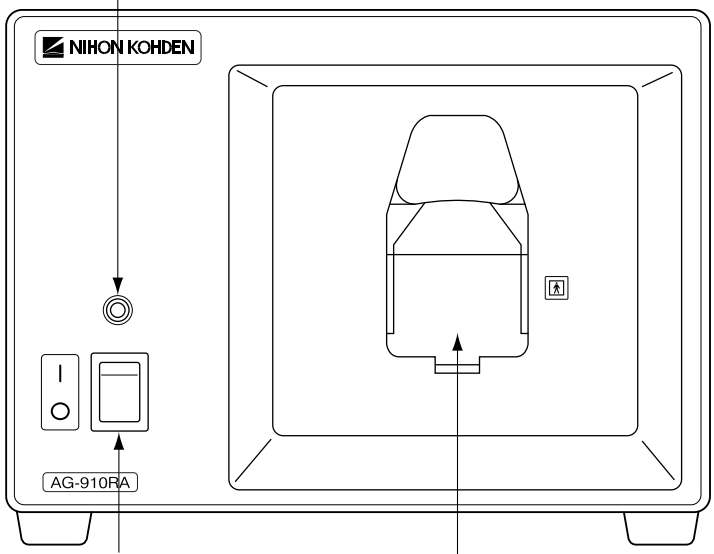
EXHAUST
Connects to the exhaust gas adapter and the scavenging system to discharge gas when using anesthetic gas.

Refer to cautions in the AG-900PA CO_2 module operator's manual.

Multi Gas Unit (AG-910RA/RK)

Front Panel

Power lamp
Lights when the power is on.



Power switch
Turns the power on/off.

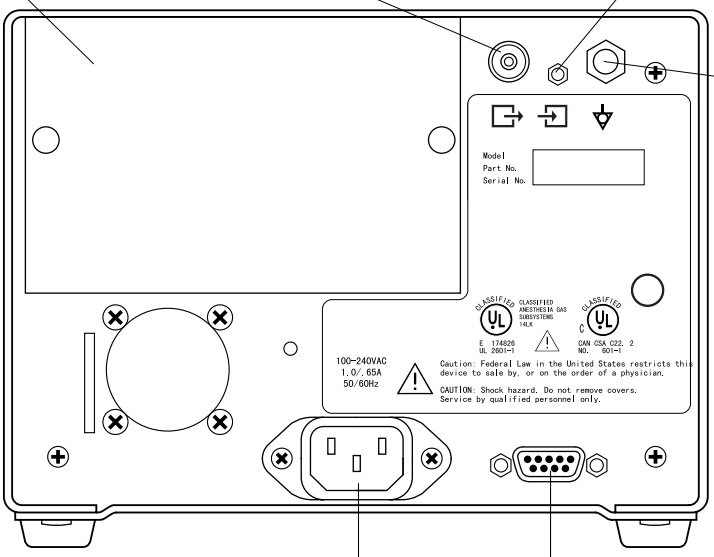
Water trap manifold
Attaches the water trap.

Rear Panel

Ventilation fan filter
Room air is blown into the multi gas unit through this filter to cool the multi gas unit.
The fan filter prevents dust from entering the multi gas unit.

Patient sample gas outlet
Connects to an anesthesia machine to waste anesthesia gas.

Zero gas inlet
Sucks air during zero calibration.
Do not block this inlet.


Model
Part No.
Serial No.
100–240VAC
1.0/.65A
50/60Hz
Caution: Federal Law in the United States restricts this device to sale by, or on the order of a physician.
CAUTION: Shock hazard. Do not remove covers.
Service by qualified personnel only.

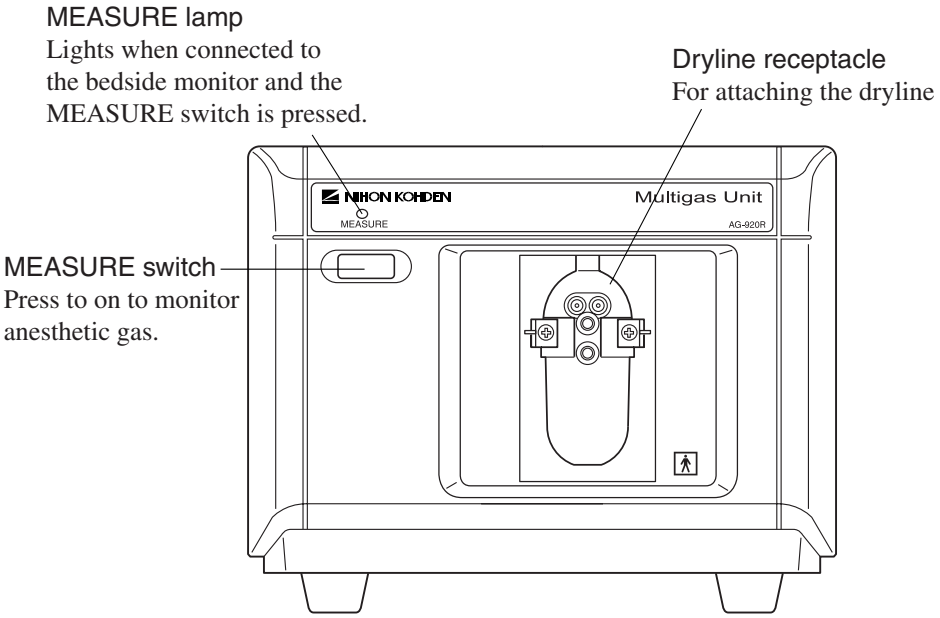
Equipotential ground terminal
Connects to the equipotential ground terminal on the wall with the grounding lead when the equipotential grounding is required.

AC power cord socket
Connects the power cord to supply AC power to the multi gas unit.

RS232C Host communication connector
Connects to the SERIAL socket of the bedside monitor for communication.

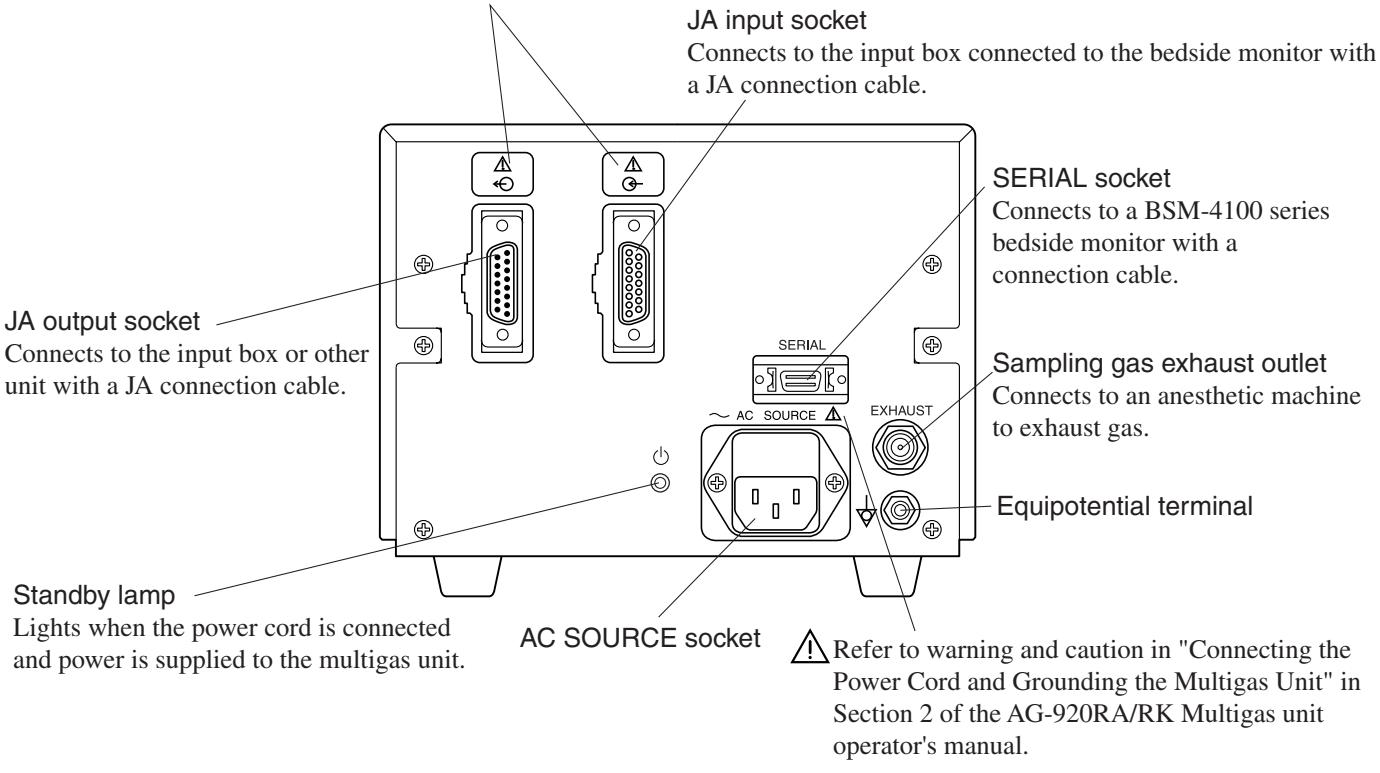
Multigas Unit (AG-920RA/RK)

Front Panel



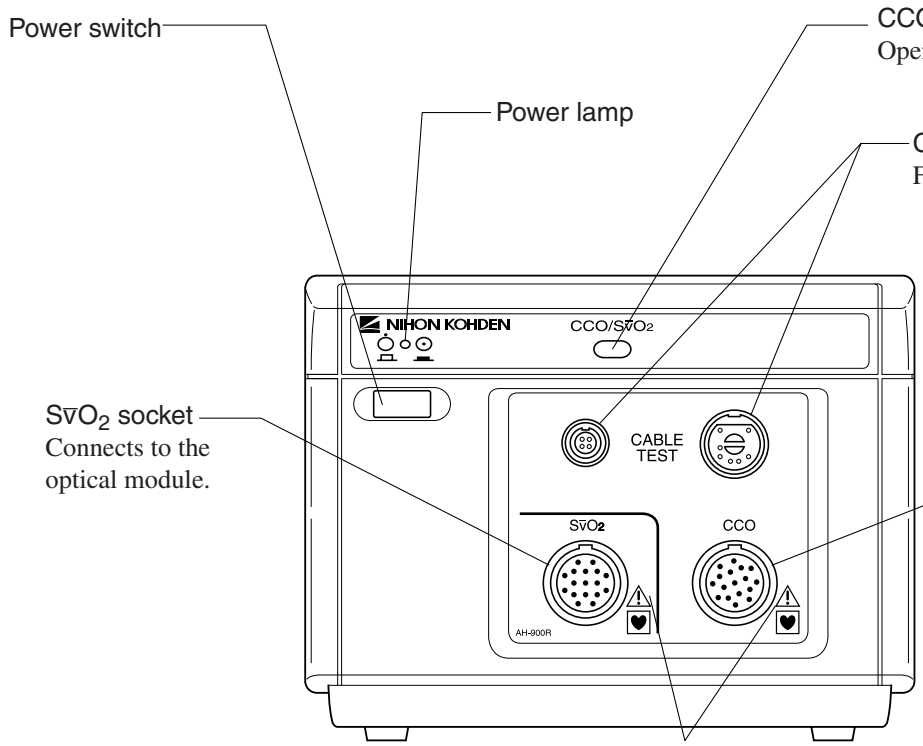
Rear Panel

⚠ Refer to caution in "Connecting the Multigas Unit and the Bedside Monitor" in Section 2 of the AG-920RA/RK Multigas unit operator's manual.

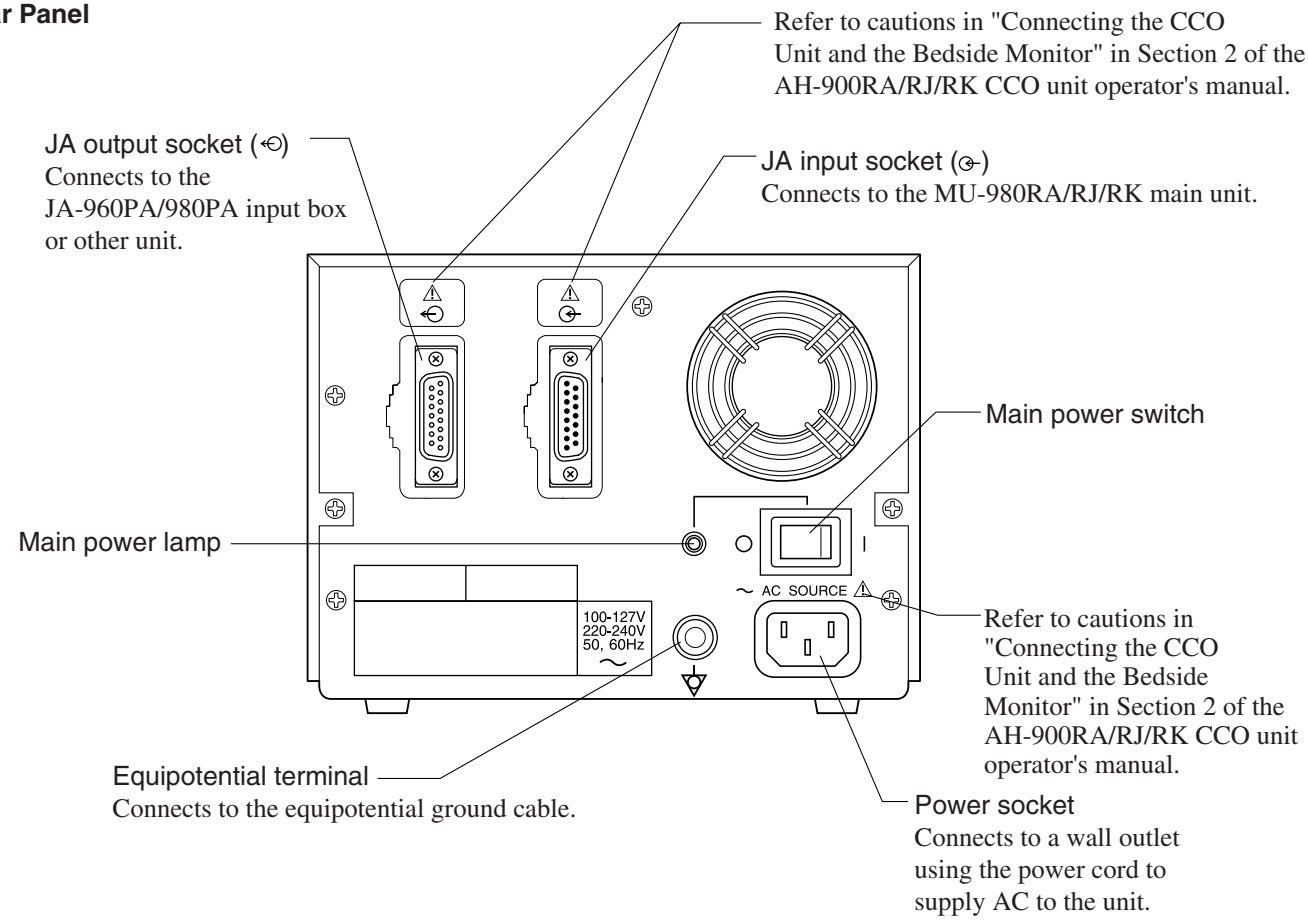

JA input socket
Connects to the input box connected to the bedside monitor with a JA connection cable.
SERIAL socket
Connects to a BSM-4100 series bedside monitor with a connection cable.
JA output socket
Connects to the input box or other unit with a JA connection cable.
SERIAL
Sampling gas exhaust outlet
Connects to an anesthetic machine to exhaust gas.
AC SOURCE
EXHAUST
Equipotential terminal
Standby lamp
Lights when the power cord is connected and power is supplied to the multigas unit.
AC SOURCE socket
⚠ Refer to warning and caution in "Connecting the Power Cord and Grounding the Multigas Unit" in Section 2 of the AG-920RA/RK Multigas unit operator's manual.

CCO Unit

Front Panel

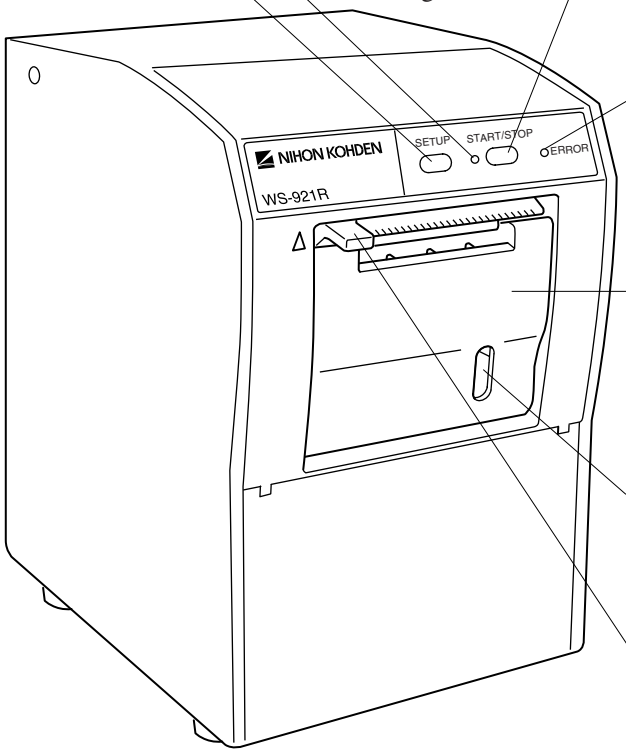


Rear Panel


Refer to cautions in "Connecting the CCO Unit and the Bedside Monitor" in Section 2 of the AH-900RA/RJ/RK CCO unit operator's manual.
JA output socket (⟲)
Connects to the JA-960PA/980PA input box or other unit.
JA input socket (⟳)
Connects to the MU-980RA/RJ/RK main unit.
Main power switch
Main power lamp
AC SOURCE
100-127V
220-240V
50, 60Hz
Refer to cautions in "Connecting the CCO Unit and the Bedside Monitor" in Section 2 of the AH-900RA/RJ/RK CCO unit operator's manual.
Equipotential terminal
Connects to the equipotential ground cable.
Power socket
Connects to a wall outlet using the power cord to supply AC to the unit.

Recorder Unit

Front Panel



SETUP key
Opens the Recording Setting window.

Recording lamp
Lights during recording.

START/STOP key
Press to start or stop recording.

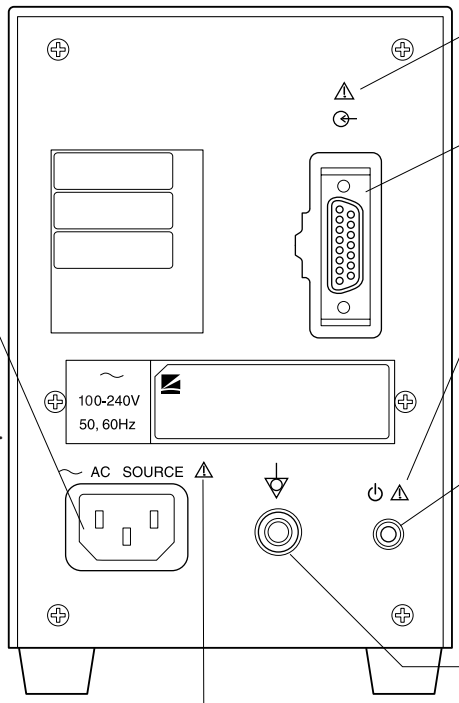
ERROR lamp
Lights when a recording error occurs.

Paper magazine
Holds recording paper.

Paper window
For checking the amount of recording paper.

Paper magazine release lever
Pull up the lever to open the paper magazine.

Rear Panel



Refer to cautions in the "Installation Conditions" section.

JA input socket
Connects to the monitor using the JA connection cable.

Refer to the "Error Messages and Troubleshooting" section if the operation lamp does not light when the power cord and JA connection cable are connected properly.

AC SOURCE socket
Connects to a wall outlet using the power cord to supply AC to the recorder unit.

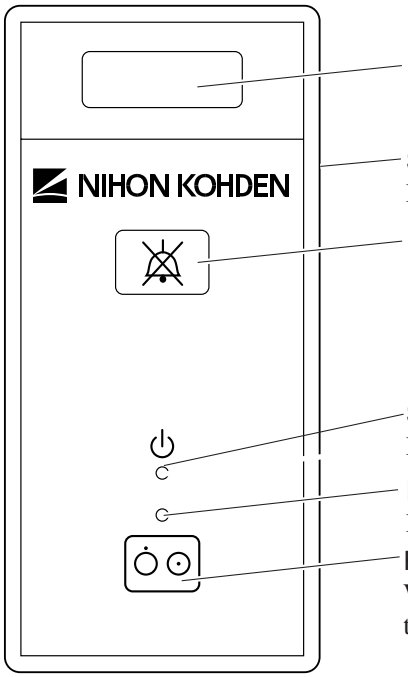
Operation lamp
Lights when the power cord and the JA connection cable are connected properly and the recorder unit is ready for recording.

Equipotential terminal
Connects to the equipotential grounding lead.

Refer to the cautions in the "Connecting the Power Cord and Grounding the Recorder Unit" section of the WS-921RA/RJ/RK operator's manual.

Display Connection Box

Front Panel



Remote control sensor
Receives the signal from the remote control.
Do not cover it and always keep it clean.

Speaker
For sync sound and alarm sound.

Silence alarms key
Silences the alarm sound.

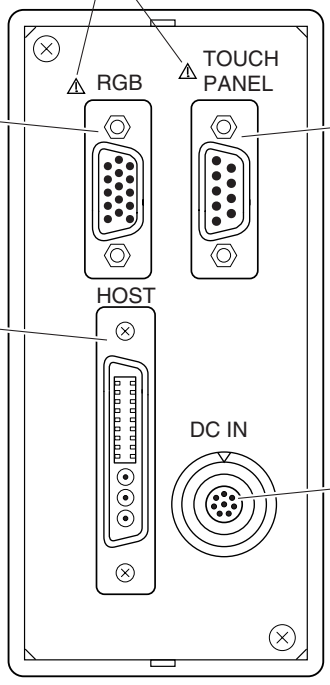
Standby lamp
Lights when the AC power switch on the main unit is on.

Power lamp
Lights when the power switch on the display connection box is on.

Power switch
When the AC power switch on the main unit is on, press this switch to display waveforms and data.

Rear Panel

Refer to "Safety Information" section of the
RY-900P display connection box operator's manual.



RGB output socket
Connects to a display unit.

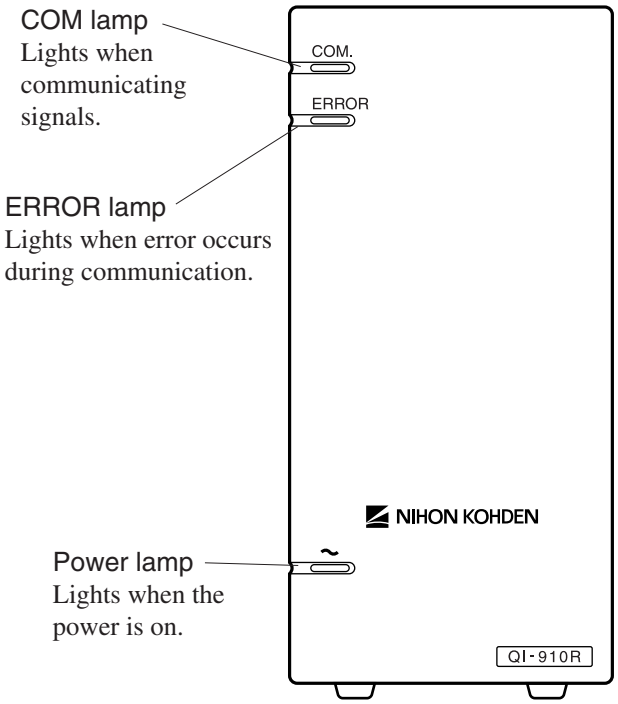
TOUCH PANEL socket
Connects to a touch screen.

HOST socket
Connects to the VD/VL socket on the main unit.

DC IN socket
Connects to the DC OUT (VL) socket on the main unit.

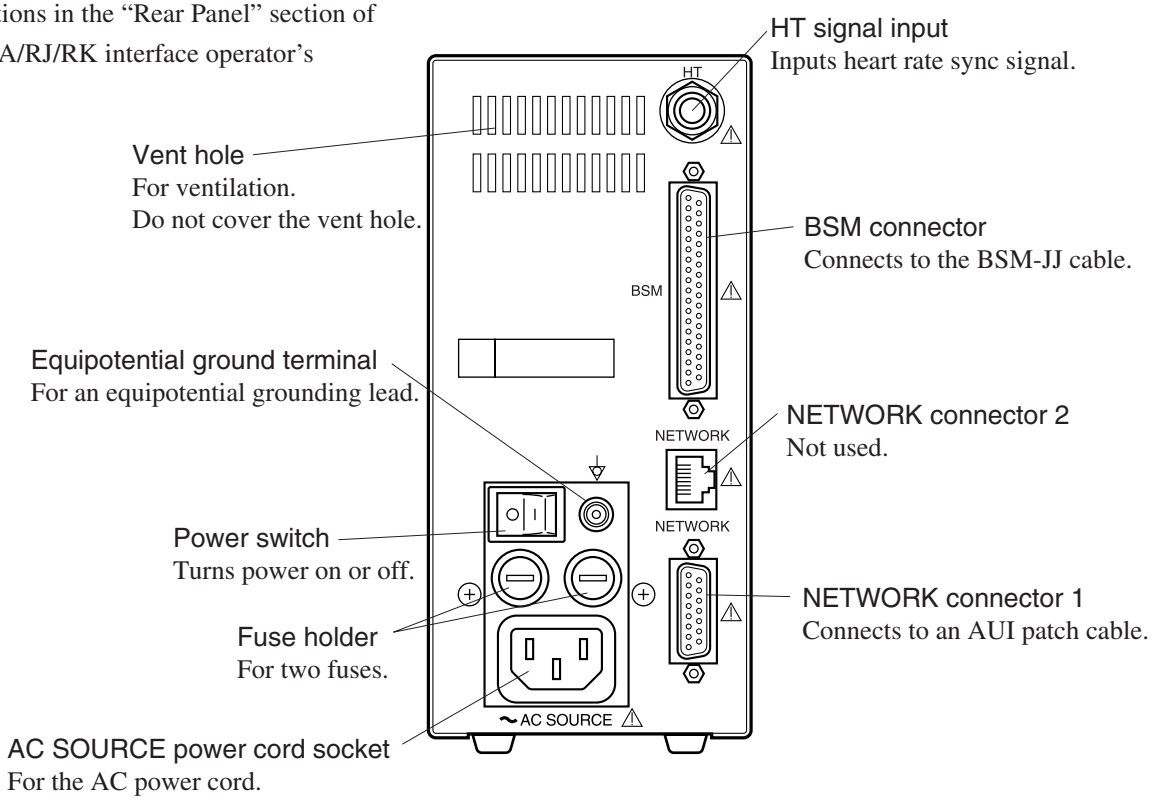
Interface

Front Panel



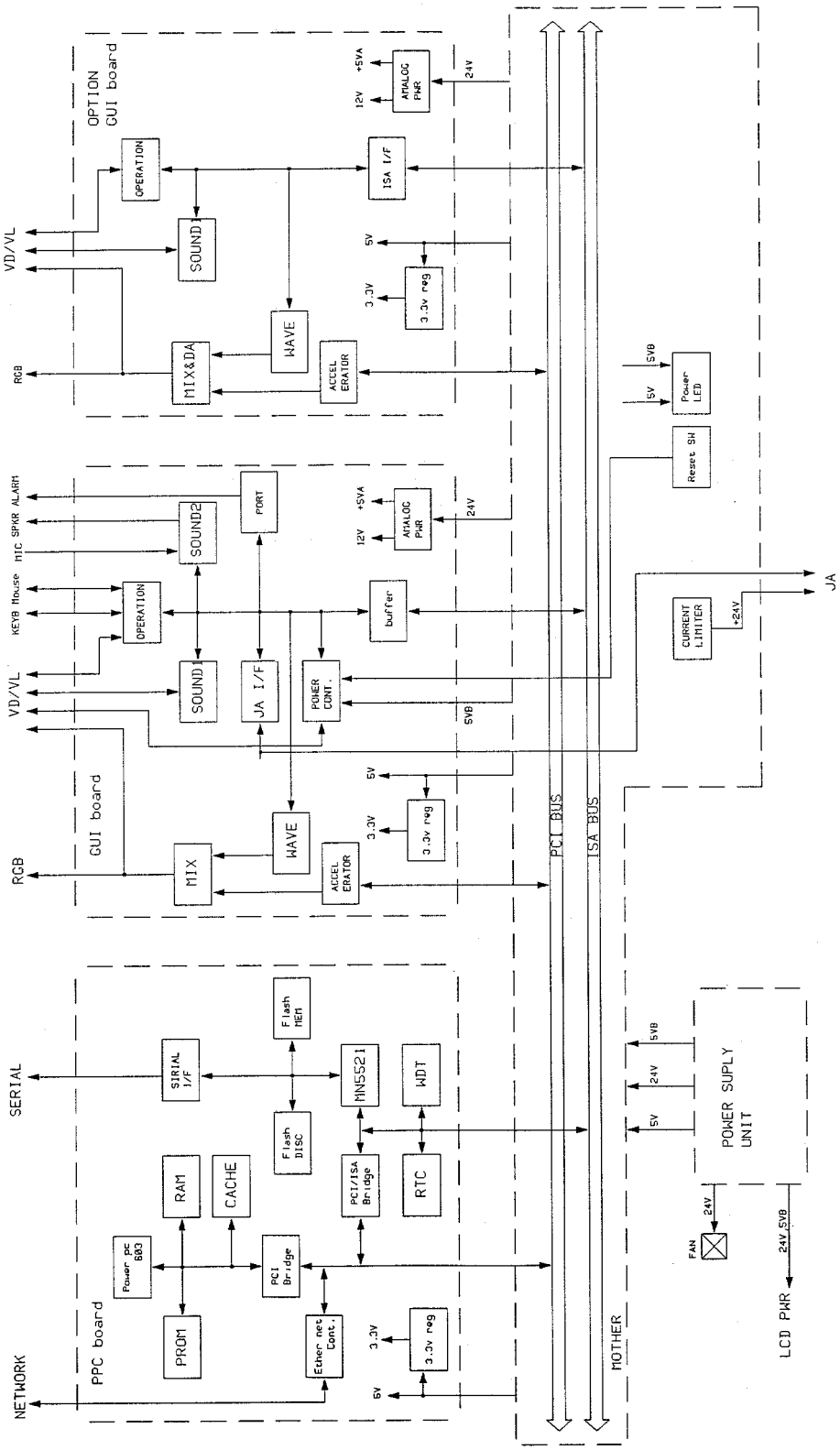
Rear Panel

⚠ Refer to cautions in the “Rear Panel” section of the QI-910RA/RJ/RK interface operator’s manual.

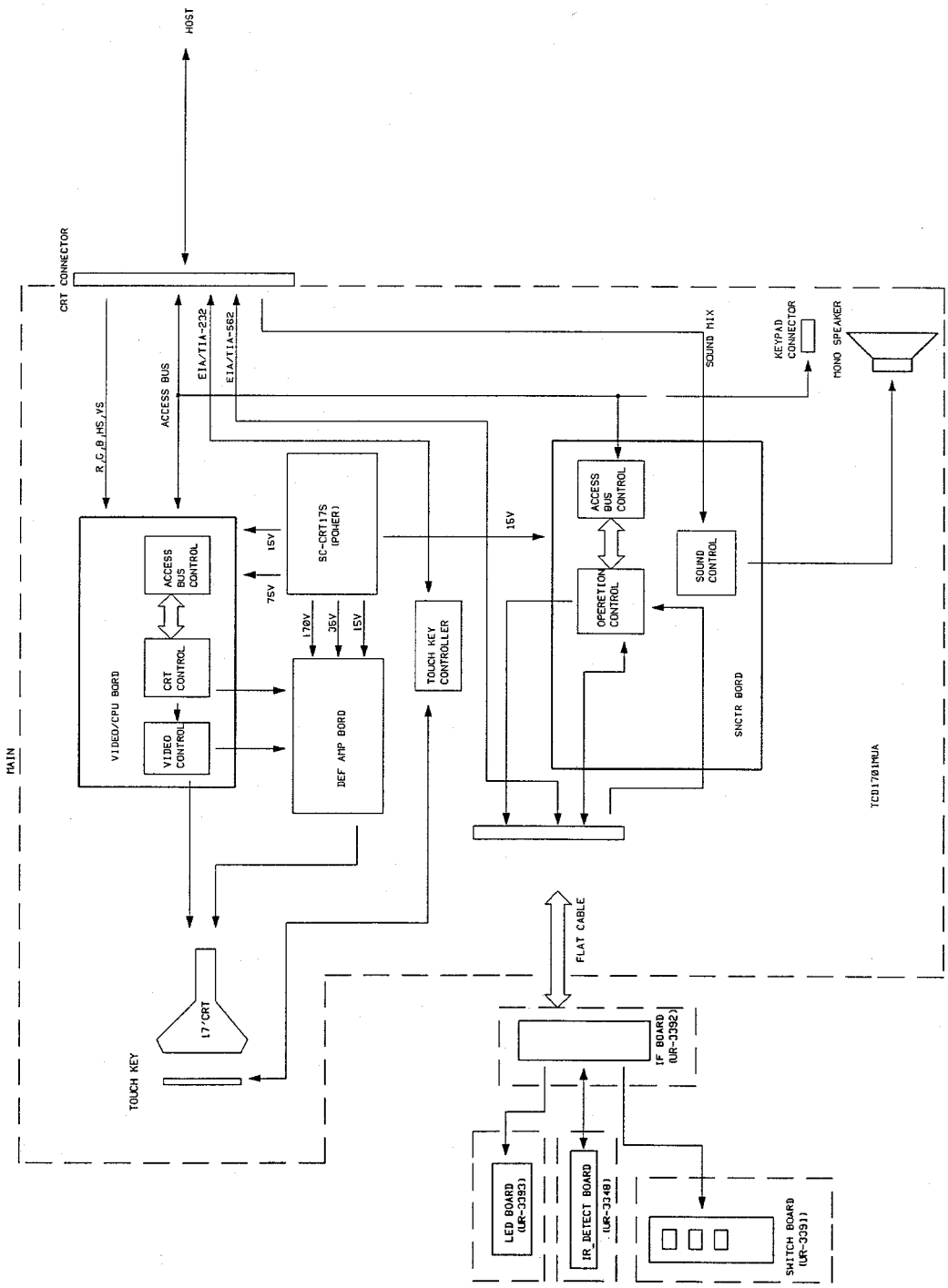


Block Diagram

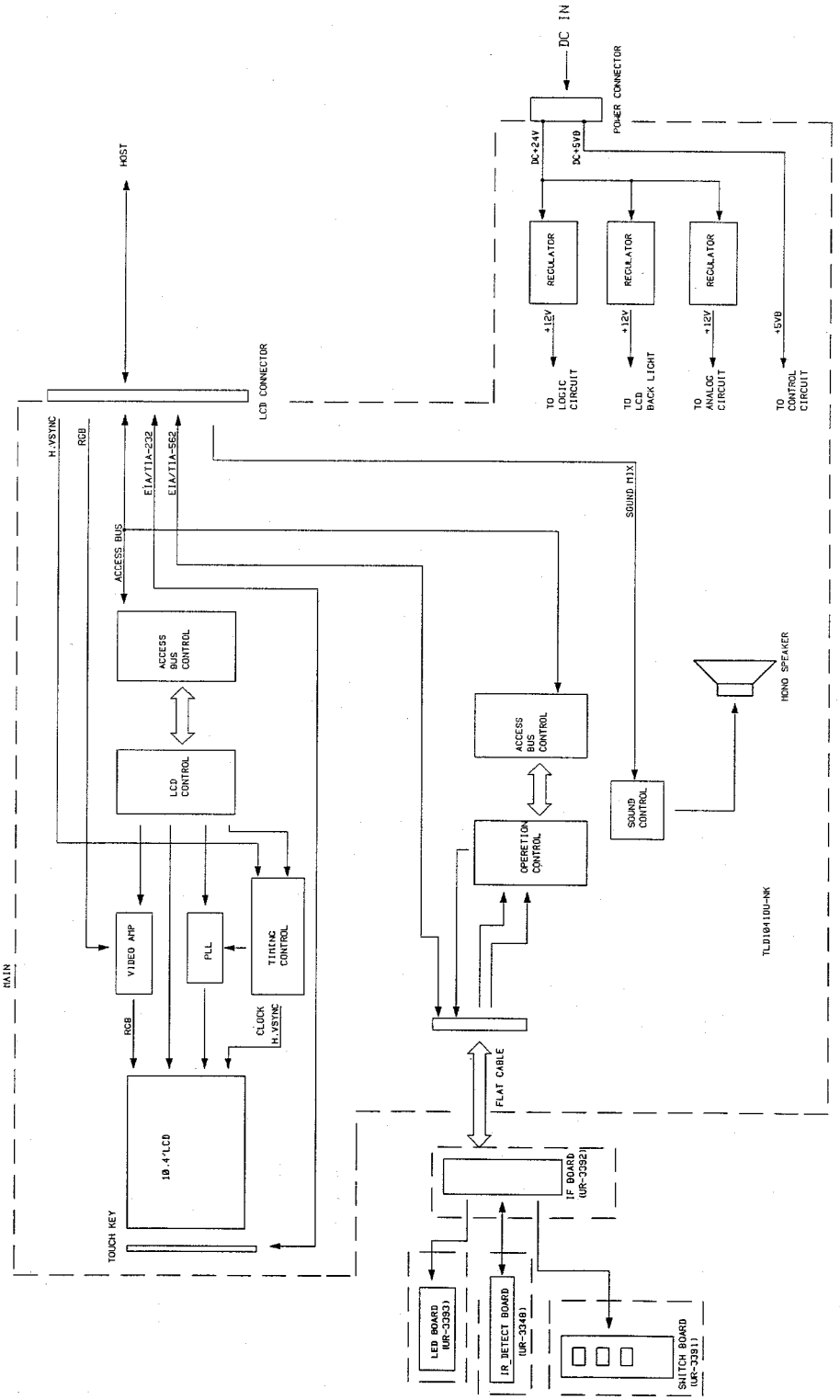
MU-980RA/RJ/RK
Main Unit



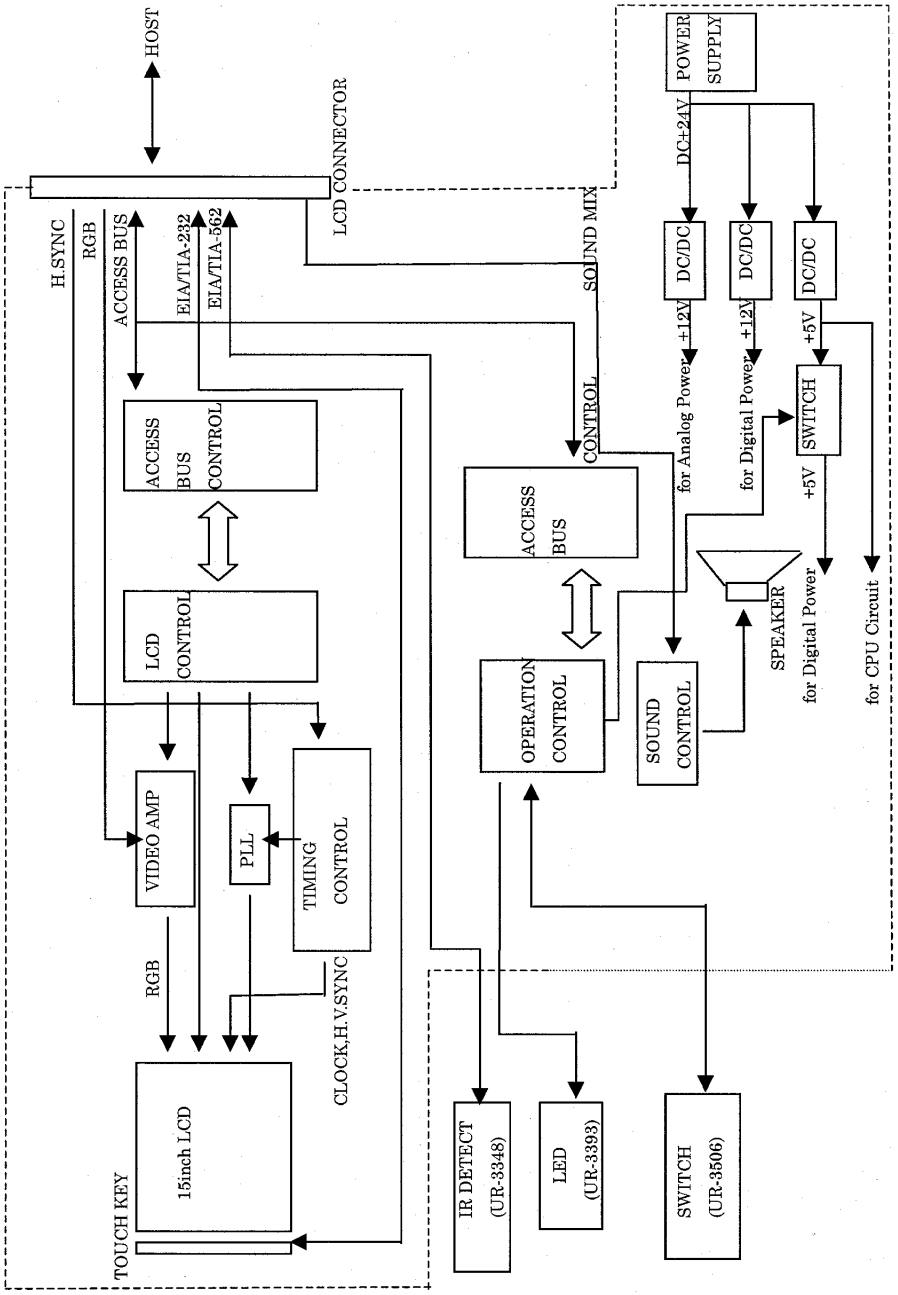
VD-900RA/RK
Color Display Unit



VL-900PA Color LCD Unit



VL-910RA Color LCD Unit



Section 2 Troubleshooting

Determining if Cause is Software or Hardware 2.1
Troubleshooting Flowchart 2.2
Troubleshooting Table 2.4
- Power-related Problems 2.5
- Display Problems 2.6
- Sound Problems 2.6
- Touch-screen Key Function Problems 2.6
- Alarm Indicator Problems 2.7
- Control Panel Problems 2.7
- Remote Control Problems 2.7
- Input Box Communication Problems 2.7
- Network Problems 2.8

This section describes how to troubleshoot the instrument, using the following:
- troubleshooting flowchart
- troubleshooting table

Determining if the Cause is Software or Hardware

You can identify whether the cause of the problem is located in the software or hardware by doing the following actions.
- Remove and reinsert the module. (This resets the module software.)
- Turn the main power switch of the main unit off then on. (This resets the main unit software.)

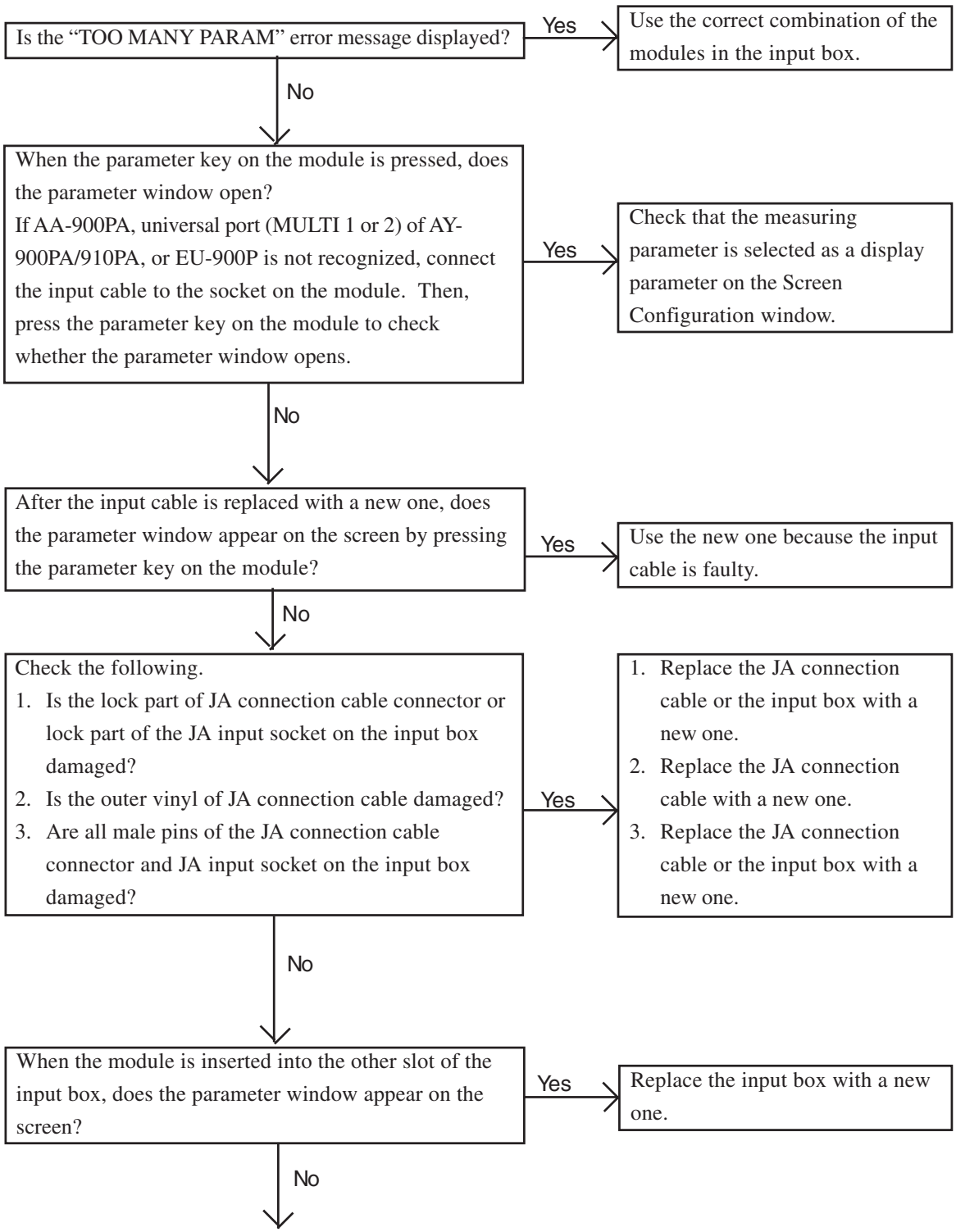
If the instrument restarts correctly, contact your Nihon Kohden representative because the probable cause is the software. If the instrument does not restart correctly, go to the “Troubleshooting Flowchart” and “Troubleshooting Table” sections because the probable cause is the hardware. If these sections do not solve the problem, contact your Nihon Kohden representative.

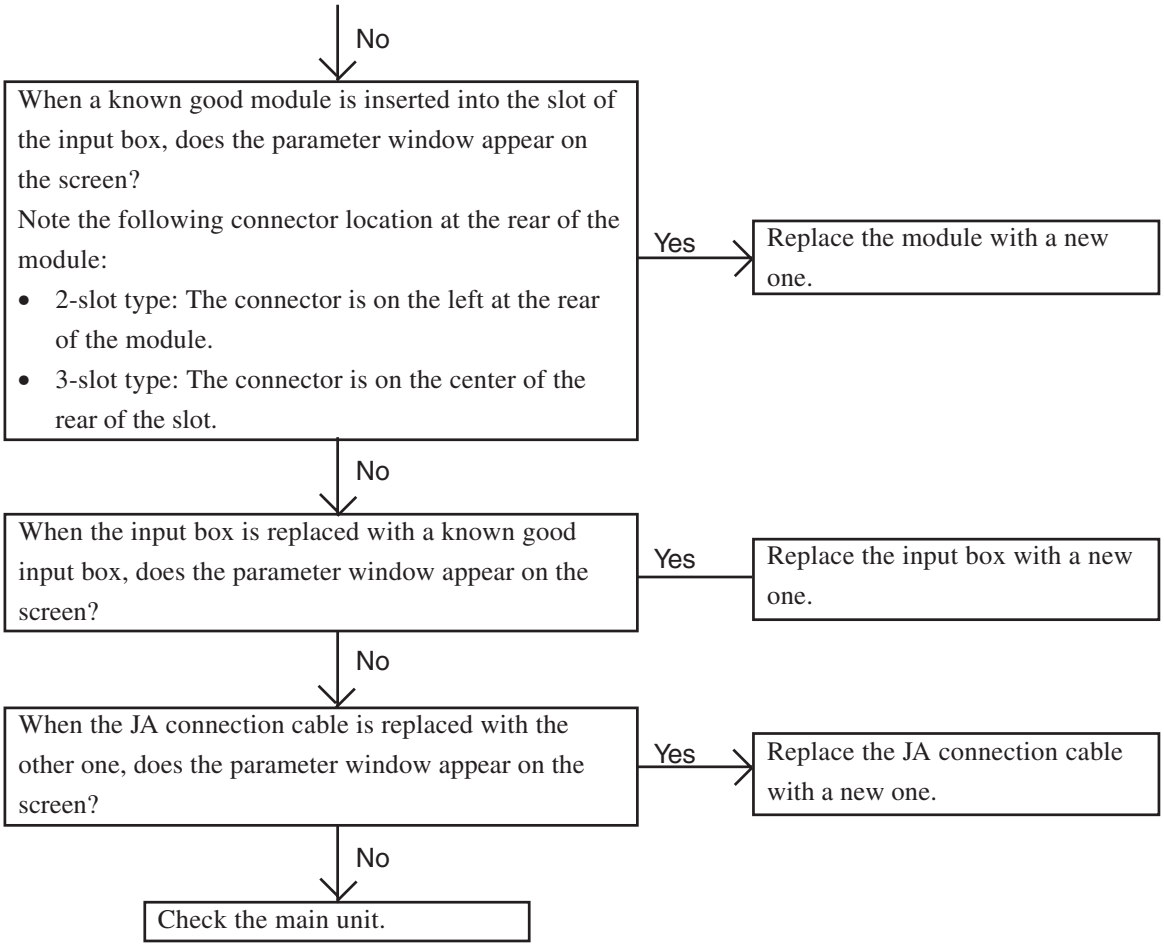
NOTE

Before contacting your Nihon Kohden representative for technical support, please provide additional detailed information on the problem. This will allow your Nihon Kohden representative to provide you with the best support.

Troubleshooting Flowchart

Use the troubleshooting flowchart to find the possible sources of the problem when the measuring parameter is not displayed.


Is the “TOO MANY PARAM” error message displayed?
Yes
Use the correct combination of the modules in the input box.
No
When the parameter key on the module is pressed, does the parameter window open?
If AA-900PA, universal port (MULTI 1 or 2) of AY-900PA/910PA, or EU-900P is not recognized, connect the input cable to the socket on the module. Then, press the parameter key on the module to check whether the parameter window opens.
Yes
Check that the measuring parameter is selected as a display parameter on the Screen Configuration window.
No
After the input cable is replaced with a new one, does the parameter window appear on the screen by pressing the parameter key on the module?
Yes
Use the new one because the input cable is faulty.
No
Check the following.
1. Is the lock part of JA connection cable connector or lock part of the JA input socket on the input box damaged?
2. Is the outer vinyl of JA connection cable damaged?
3. Are all male pins of the JA connection cable connector and JA input socket on the input box damaged?
Yes
1. Replace the JA connection cable or the input box with a new one.
2. Replace the JA connection cable with a new one.
3. Replace the JA connection cable or the input box with a new one.
No
When the module is inserted into the other slot of the input box, does the parameter window appear on the screen?
Yes
Replace the input box with a new one.
No


No
When a known good module is inserted into the slot of the input box, does the parameter window appear on the screen?
Note the following connector location at the rear of the module:
• 2-slot type: The connector is on the left at the rear of the module.
• 3-slot type: The connector is on the center of the rear of the slot.
Yes
Replace the module with a new one.
No
When the input box is replaced with a known good input box, does the parameter window appear on the screen?
Yes
Replace the input box with a new one.
No
When the JA connection cable is replaced with the other one, does the parameter window appear on the screen?
Yes
Replace the JA connection cable with a new one.
No
Check the main unit.

Troubleshooting Table

Use the troubleshooting table to locate, identify, and solve a problem in the instrument. The problems are divided into general problem areas. Each category has its own troubleshooting table for fast and easy troubleshooting.

- Power-related Problems
- Display Problems
- Sound Problems
- Touch-screen Key Function Problems
- Alarm Indicator Problems
- Control Panel Problems
- Remote Control Problems
- Input Box Communication Problems
- Network Problems

How to use the troubleshooting table

1. Determine which troubleshooting table to use.
2. In the “Problem” or “Error Message” column, find the trouble item that matches the problem.
3. Do the action recommended in the “Action” column.
4. If the problem is not solved, do the action for the next possible cause or criteria.
5. If none of the actions solve the problem, contact your Nihon Kohden representative.

Power-related Problems

Problem	Probable Causes/Criteria		Action
The power of the main unit does not turn on.	The AC power switch on the rear panel of the main unit is off.		Turn on the AC power switch on the rear panel of the main unit.
	When the standby lamp of the main unit does not light even if the AC power switch on the rear panel of the unit is on.	No AC power input.	Check the AC power line.
		The standby lamp lights if the GUI board is removed.	Replace the GUI board.
		The standby lamp lights if the DC power cord is disconnected from the VL-900PA or RY-900P.	Replace the VL-900PA or RY-900P.
		Other causes.	Replace the main unit.
	When the power lamp of the main unit does not light even if the power switch of the VL-900PA or RY-900P is pressed.	The power lamp lights if the PPC board is removed.	Replace the PPC board.
		The power lamp lights if the GUI board is removed.	Replace the GUI board.
		The power lamp lights if the DC power cord is disconnected from the VL-900PA or RY-900P.	Replace the VL-900PA or RY-900P.
		Other causes.	Replace the main unit.
The power of the VD-900RA/K color display unit or VL-910RA color LCD unit does not turn on.	The AC power switch of the VD-900RA/K or VL-910RA is off.		Turn on the AC power switch on the rear panel of the VD-900RA/K or VL-910RA.
	When the standby lamp of the VD-900RA/K or VL-910RA does not light even if the AC power switch of the VD-900RA/K or VL-910RA is on.	No AC power input.	Check the AC power line.
		The standby lamp lights if the control panel is removed from the VD-900RA/K or VL-910RA.	Replace the control panel.
		Other causes.	Replace the VD-900RA/K or VL-910RA.
	When the power lamp of the VD-900RA/K or VL-910RA does not light even if the front power switch of the VD-900RA/K or VL-910RA is pressed.	The power lamp lights if the control panel is removed from the VD-900RA/K or VL-910RA.	Replace the control panel.
		Other causes.	Replace the VD-900RA/K or VL-910RA, or main unit.
The power of the VL-900PA color LCD unit does not turn on.	When the standby lamp of the VL-900PA does not light even if the AC power switch of the main unit is on.	No DC power input.	Check the DC power cord and main unit.
		The standby lamp lights if the control panel is removed from the VL-900PA.	Replace the control panel.
		Other causes.	Replace the VL-900PA.
	When the power lamp of the VL-900PA does not light even if the power switch of the VL-900PA is on.	The power lamp lights if the control panel is removed from the VL-900PA.	Replace the control panel.
		Other causes.	Replace the VL-900PA.
The power of the RY-900P display control box does not turn on.	When the standby lamp of the RY-900P does not light even if the AC power switch of the main unit is on.	No DC power input.	Check the DC power cord and main unit.
		If the RY-900P is replaced with VL-900PA, the power lamp of the VL-900PA lights.	Replace the RY-900P.
		Other causes.	Replace the main unit.
	When the power lamp of the RY-900P does not light even if the power switch of the RY-900P is on.	No communication between the RY-900P and main unit.	Check the display cable.
		The power switch has a malfunction.	Replace the RY-900P.

Display Problems

Problem	Probable Causes/Criteria	Action
No display.	Faulty connection of the display cable between the main unit and display unit.	Check that the display cable is firmly connected. Check that provided RGB cable is firmly connected when RY-900P is used.
The screen is dark.	Screen brightness and contrast out of adjustment.	Adjust the setting on the Display window of the Setup Menu window. Refer to Part I, Section 5 of the BSS-9800 operator's manual.
	Faulty GUI board.	Replace the GUI board.
The screen displays are abnormal.	Faulty connection of the display cable between the main unit and display unit.	Check that the display cable is firmly connected.
	Faulty GUI board.	Replace the GUI board.
	Faulty display unit.	Replace the display unit.
	Damaged display cable.	Replace the display cable.

Sound Problems

Problem	Probable Causes/Criteria	Action
No sound.	Faulty connection of the display cable between the main unit and display unit.	Check that the display cable is firmly connected.
	Faulty GUI board.	Replace the GUI board.
	Faulty display unit.	Replace the display unit.
	Faulty RY-900P.	Replace the RY-900P.
	Damaged display cable.	Replace the display cable.
Sound volume cannot be adjusted.	Faulty GUI board.	Replace the GUI board.

Touch-screen Key Function Problems

Problem	Probable Causes/Criteria	Action
The touch screen does not function correctly.	Faulty connection of the display cable between the main unit and display unit.	Check that the display cable is firmly connected.
	Faulty GUI board.	Replace the GUI board.
	Faulty display unit.	Replace the display unit.
	Damaged display cable.	Replace the display cable.
An unintended touch point on the screen responds.	The touch screen is calibrated incorrectly	Calibrate the touch screen on the Cal Touch Screen window of the Setup Menu window. Refer to Part I, Section 7 of the BSS-9800 operator's manual.
	Faulty display unit.	Replace the display unit.

Alarm Indicator Problems

Problem	Probable Causes/Criteria	Action
The alarm indicator does not light.	If both the control panel on the display unit and remote control work correctly, faulty display unit.	Replace the display unit.
	If neither the control panel on the display unit nor the remote control work correctly, faulty GUI board or damaged display cable.	Replace the GUI board or display cable.

Control Panel Problems

Problem	Probable Causes/Criteria	Action
Control panel on the display unit does not work correctly.	If the remote control also does not work correctly, faulty GUI board or damaged display cable.	Replace the GUI board display cable.
	If the remote control works correctly, faulty control panel on the display unit.	Replace the control panel on the display unit.

Remote Control Problems

Problem	Probable Causes/Criteria	Action
Remote control does not work correctly.	The remote control battery is weak.	Replace the battery of the remote control.
	If the control panel on the display unit also does not work correctly, faulty GUI board or damaged display cable.	Replace the GUI board or display cable.
	If the control panel on the display unit works correctly, faulty remote control.	Replace the remote control.

Input Box Communication Problems

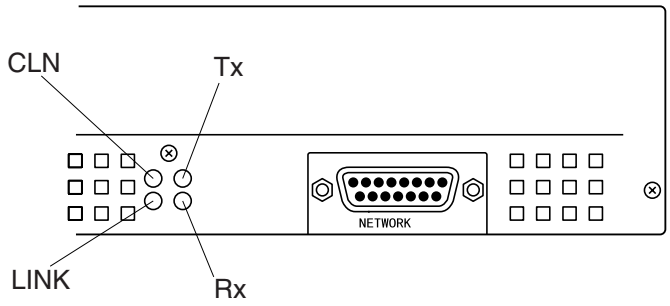
Error Message	Probable Causes/Criteria	Action
TOO MANY COMM. ERRORS	Faulty connection between the module and input box.	Check the connection between the module and input box.
	Faulty input box.	Replace the input box.
	Faulty module.	Replace the module.
	Faulty unit.	Replace the unit.
	Faulty GUI board.	Replace the GUI board.
	Damaged communication cable.	Replace the communication cable.
	Damaged data due to external noise.	Securely connect the connection cables with holder.
TOO MANY MODULES	Too many input boxes and units are connected to the main unit.	Use two or less input boxes and units for connection to the main unit.
	Too many modules are put into the input box.	Use no more than the specified number of modules.
	Faulty combination of installed modules in the input box.	Use the correct combination of the installed modules in the input box.

Network Problems

<table>
<tr><th>Problem</th><th colspan="2">Probable Causes/Criteria</th><th>Action</th></tr>
<tr><td rowspan="9">The central monitor does not display the waveforms and numeric data of the specified patient or the patient cannot be selected at the central monitor.</td><td colspan="2">The bedside monitor is not turned on.</td><td>Turn on the bedside monitor.</td></tr>
<tr><td colspan="2">The IP address of the bedside monitor is wrong.</td><td>Set the correct IP address.</td></tr>
<tr><td rowspan="2">The power indicator of the MAU which is connected to the bedside monitor through the AUI patch cable is not lit.</td><td>The AUI patch cable is disconnected.</td><td>Firmly connect the AUI patch cable between the bedside monitor and MAU.</td></tr>
<tr><td>Other causes.</td><td>Replace the following with a new one.
● AUI patch cable
● MAU
● PPC board</td></tr>
<tr><td rowspan="3">The LINK* indicator of the MAU which is connected to the bedside monitor through the AUI patch cable is not lit.</td><td>10Base-T cable is disconnected.</td><td>Connect the 10Base-T cable between the MAU and HUB.</td></tr>
<tr><td>The RJ-45 plug has damage at the plastic hook or at the resin between the terminals.</td><td>Contact an authorized local area network construction company in your country to replace the RJ-45 plug with a new one.</td></tr>
<tr><td>The HUB which is connected to the bedside monitor through the 10Base-T cable is off.</td><td>Turn on the HUB.</td></tr>
<tr><td colspan="2">Other causes.</td><td>Replace the following with a new one.
● HUB
● 10Base-T cable
● MAU</td></tr>
<tr><td colspan="2">The Rx* indicator on the rear panel of the bedside monitor does not blink.</td><td>Replace the following with a new one.
● HUB
● MAU
● PPC board</td></tr>
<tr><td rowspan="8">The central monitor does not display the waveforms and numeric data of any patients in the network or no patient can be selected at the central monitor.</td><td colspan="3">Check each bedside monitor using the above troubleshooting.</td></tr>
<tr><td rowspan="2">The power indicator of the MAU which is connected to the central monitor through the AUI patch cable is not lit.</td><td>The AUI patch cable has poor contact between the bedside monitor and MAU.</td><td>Firmly connect the AUI patch cable between the central monitor and MAU.</td></tr>
<tr><td>Other causes.</td><td>Replace the following with a new one.
● AUI patch cable
● MAU
● PPC board</td></tr>
<tr><td rowspan="3">The LINK* indicator of the MAU which is connected to the central monitor through the AUI patch cable is not lit.</td><td>10Base-T cable is disconnected.</td><td>Connect the 10Base-T cable between the MAU and HUB.</td></tr>
<tr><td>The RJ-45 plug has damage at the plastic hook or at the resin between the terminals.</td><td>Contact an authorized local area network construction company in your country to replace the RJ-45 plug with a new one.</td></tr>
<tr><td>The HUB which is connected to the central monitor through the 10Base-T cable is off.</td><td>Turn on the HUB.</td></tr>
<tr><td>Other causes.</td><td>Replace the following with a new one.
● HUB
● 10Base-T cable
● MAU</td></tr>
</table>

Problem	Probable Causes/Criteria		Action
The waveforms of the specified patient sometimes disappear from the central monitor.	The power indicator of the MAU which is connected to the bedside monitor through the AUI patch cable is sometimes not lit.	The AUI patch cable has poor contact between the bedside monitor and MAU.	Firmly connect the AUI patch cable between the bedside monitor and MAU.
		Other causes.	Replace the AUI patch cable with a new one.
	The LINK* indicator of the MAU which is connected to the bedside monitor through the AUI patch cable is sometimes not lit.	10Base-T cable has poor contact between the MAU and HUB.	Connect the 10Base-T cable between the MAU and HUB.
		Other causes.	Replace the 10Base-T cable with a new one.
	The 10Base-T cable is placed close to a source of noise such as an AC mains line.		Place the 10Base-T cable away from the source of noise.
The waveforms of all patients sometimes disappear from the central monitor at the same time.	Check each bedside monitor using the top troubleshooting.		
	The power indicator of the MAU which is connected to the bedside monitor through the AUI patch cable is sometimes not lit.	The AUI patch cable has poor contact between the bedside monitor and MAU.	Firmly connect the AUI patch cable between the bedside monitor and MAU.
		Other causes.	Replace the AUI patch cable with a new one.
	The LINK* indicator of the MAU which is connected to the bedside monitor through the AUI patch cable is sometimes not lit.	10Base-T cable has poor contact between the MAU and HUB.	Connect the 10Base-T cable between the MAU and HUB.
		Other causes.	Replace the 10Base-T cable with a new one.
	The 10Base-T cable is placed close to a source of noise such as an AC mains line.		Place the 10Base-T cable away from the source of noise.
	The HUB which is connected to the bedside monitor through the 10Base-T cable is intermittently turned off.		Replace the following with a new one. ● Mains power supply for HUB ● Power cord ● HUB
	The CLN* indicator on the rear panel of the central monitor is sometimes kept on.	Equipment other than the BSS-9800 monitors and related instruments, e.g. personal computer, is connected to the network.	Disconnect the equipment from the network.
		Too many bedside and central monitors are connected to the network.	Keep the number of connectable monitors within the maximum in the network.

* See below



MU-980RA/RJ/RK main unit rear panel

CLN: Indicates data collision.
LINK: Indicates link condition.
Tx: Indicates data transmission.
Rx: Indicates data receiving.

Section 3 Diagnostic Check

Introduction 3.1
Power On Self Check 3.2
Calling Up the Diagnostic Check and System Setup Screen 3.3
Performing Diagnostic Checks 3.4
- Calling Up the MU/VD Manual Check Menu Screen 3.5
- PPC Check Menu Items 3.6
  - Card ROM Check 3.7
  - Disk Check 3.7
  - Network I/F Check 3.10
  - Serial Check 3.10
- GUI Check Menu Items 3.11
  - Wave RAM Check 3.12
  - Wave Display 1 and 2 Check 3.13
  - Graphic Display Check 3.15
  - Sound 1 Check 3.16
  - Sound 2 Check 3.17
  - Touch Key I/F Check 3.18
  - IrDA I/F Check 3.18
  - Access Bus I/F Check 3.19
  - Temperature Sensor Check 3.20
  - Alarm Pole Check 3.21
  - JA I/F RAM Check 1 and 2 ..... 3.22
  - JA I/F Internal Loop Back Check 3.23
  - JA I/F External Loop Back Check 3.23
  - JA I/F Ctl Check 3.24
  - Keyboard I/F Check 3.24
  - Mouse I/F Check 3.25
  - AC Source Check 3.25
  - Fan ON/OFF Check 3.26
- VD(VL) Check Menu Items 3.28
  - Focus Check 3.29
  - Viewrity Check (Graphic display check) 3.29
  - Configuration Check 3.30
  - Communication Check 3.30

Operation Unit Check 3.31
Remote Controller Check 3.32
Touch Key Check 3.33
Touch Key Calibration 3.34
Alarm Indicator Check 3.35
IrDA Check 3.36
ASK Check 3.37
HPSIR Check 3.38
Screen Setup 3.39
Degauss 3.40
Brightness 3.41
Contrast 3.42
H-Position 3.42
H-Size 3.43
V-Position 3.43
V-Size 3.44
Pincushion 3.44
Screen Save 3.45
Other Check 3.46
Keyboard Check 3.47
Mouse Check 3.48

Introduction

The instrument has an automatic power on self check as well as a complete set of diagnostic checks that you can perform at any time.

All errors detected in the power on self check, diagnostic checks and any time during operation are stored in an error history table.

The diagnostic checks, error history, system setup and initialization are accessed from the Diagnostic Check and System Setup screen.

In this section, keys which are displayed on the screen are indicated by brackets, for example, the [Monitor Mode] key.

Power On Self Check

This self check is performed every time the power switch of the display unit is turned on. During the power on self check, the alarm sound occurs and alarm indicator is lit. If no fatal error is detected, the normal operating mode begins and the patient monitoring display appears after the “Wait a minute” message display. If a fatal error is detected, the Diagnostic Check and System Setup screen appears and the error code is stored in the error history.

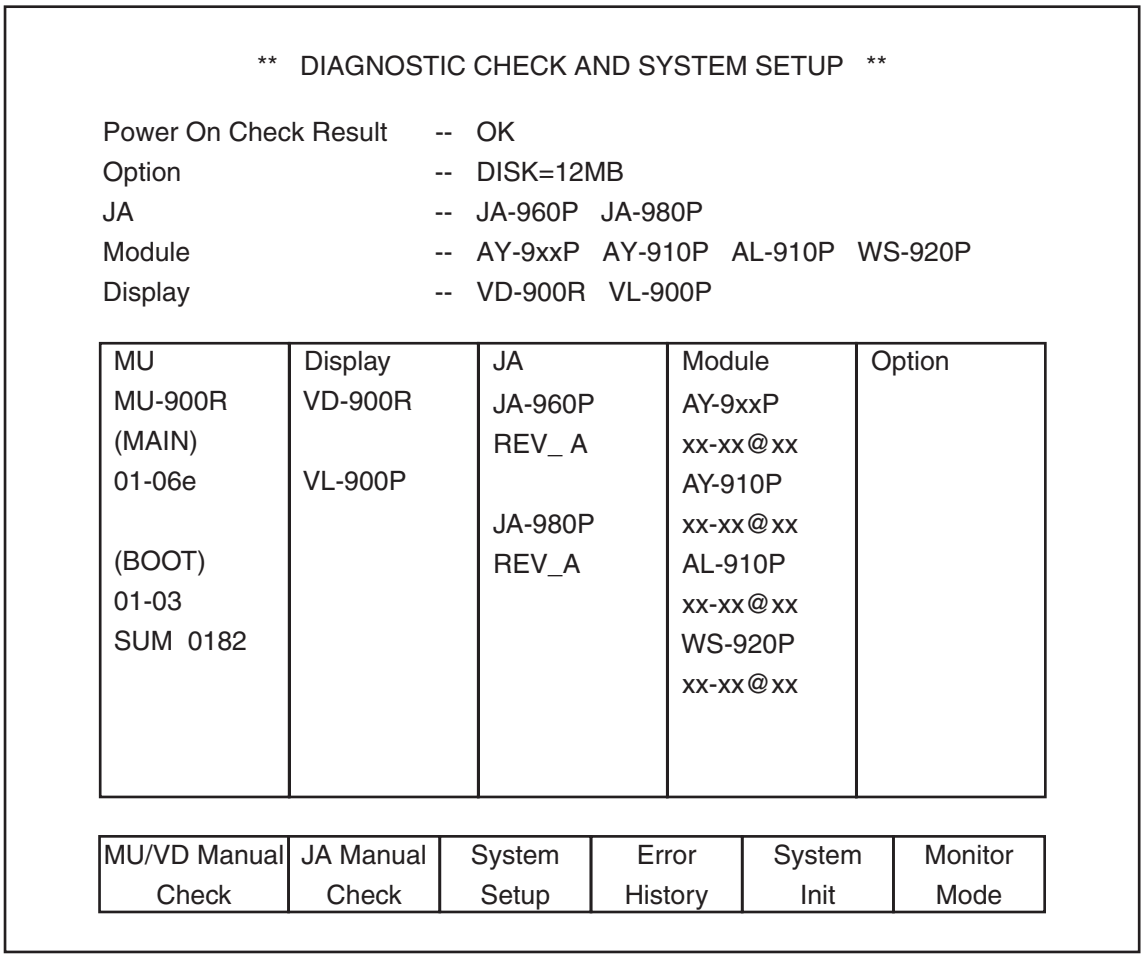
Calling Up the Diagnostic Check and System Setup Screen

To view the error history or perform diagnostic or system setup or initialization, use the keys on this screen. Keys are indicated by brackets, for example, [MU/VD Manual Check].

1. Do either of the following.
   a. With the power off, press the power switch of the display unit while holding the SILENCE ALARMS key on the control panel or remote control then hold the SILENCE ALARMS key until the Diagnostic Check and System Setup screen appears.

   Or,

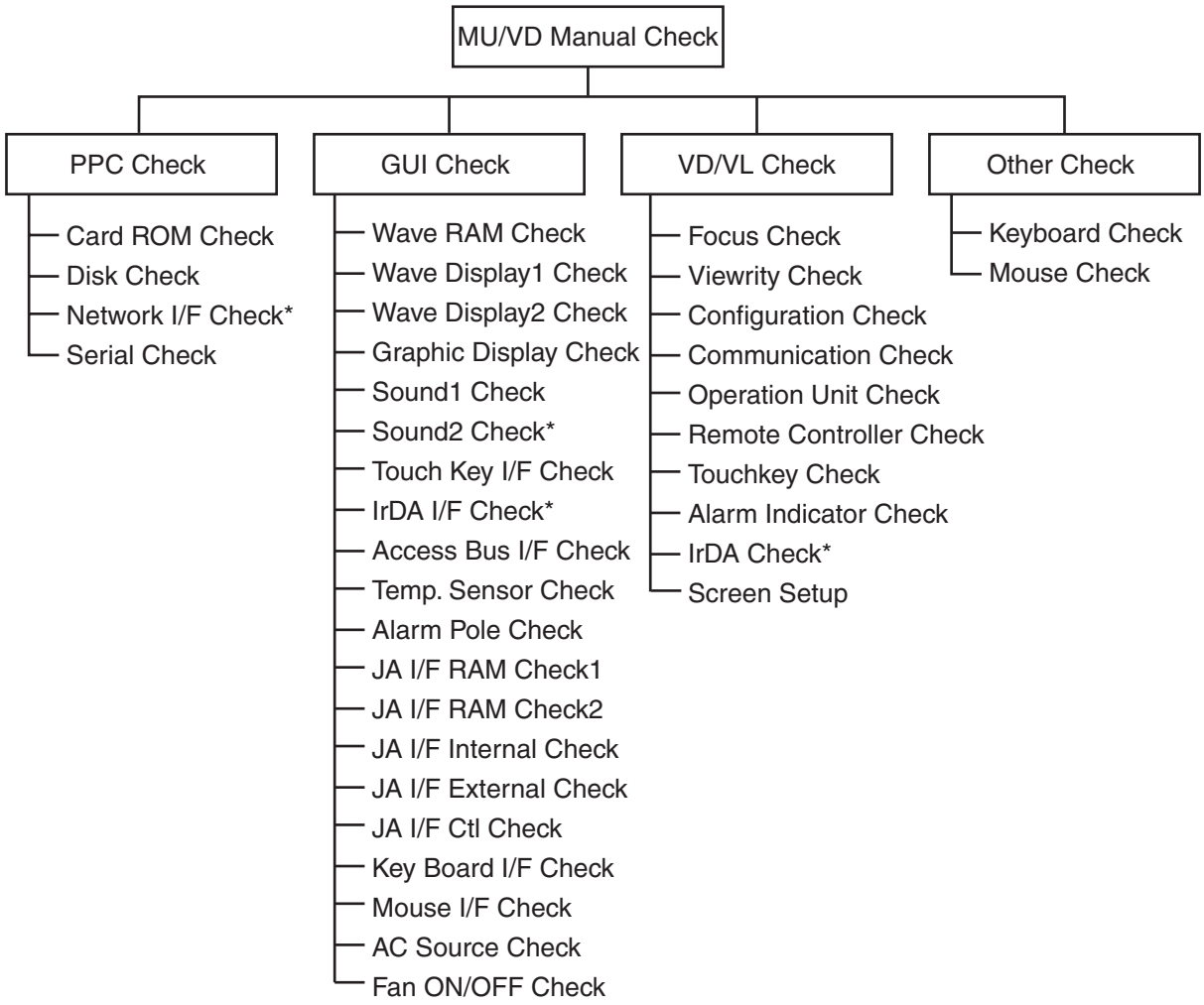
   b. Press and hold down the reset switch at the left side of the main unit for 2 seconds with a sharp pointed abject such as a pen. The reset switch is hidden by the cover of the monitor vent hole. You need to remove the cover of the monitor vent hole to expose the reset switch. Refer to "Maintenance" section of the BSS-9800 Operator's Manual for how to remove the cover of the monitor vent hole.



2. To exit the Check and System Setup screen and return to the patient monitoring mode, select the [Monitor Mode] key.

Performing Diagnostic Checks

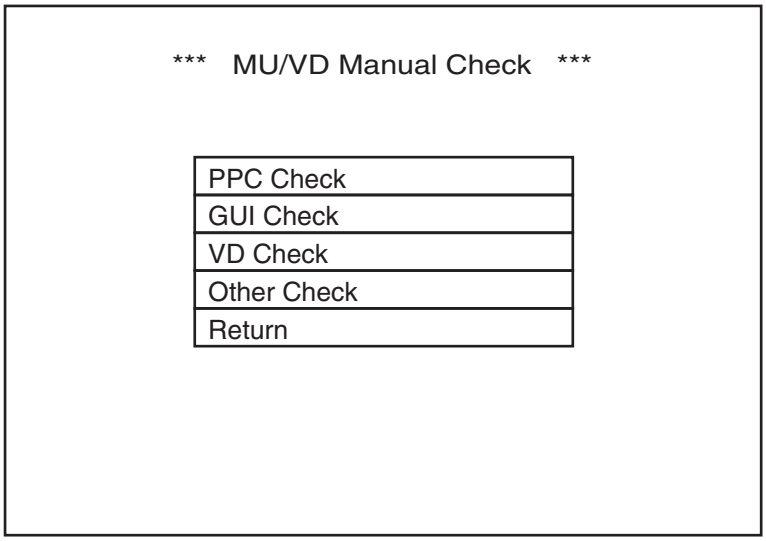
The following diagnostic checks are available. If an error is detected in the power on self check or the instrument does not work correctly, find which board or unit is faulty using the diagnostic check and fix the faulty board or unit at the board or unit level.

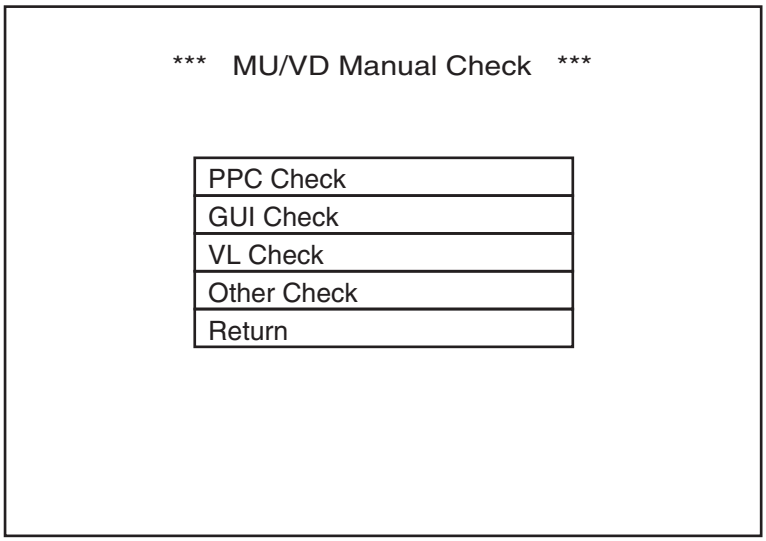


* Not available

Calling Up the MU/VD Manual Check Menu Screen

1. From the Diagnostic Check and System Setup screen, select the [MU/VD Manual Check] key. The MU/VD Manual Check Menu screen appears. On the screen of the color display unit (VR-900RA/K), the [VD Check] key is displayed: On the screen of the color LCD unit (VL-900PA/VL-910RA), the [VL Check] key is displayed as shown below.





2. To call up the PPC, GUI, VD/VL, or Other Manual Check Menu screen, select the [PPC Check], [GUI Check], [VD/VL Check], or [Other Check] key.

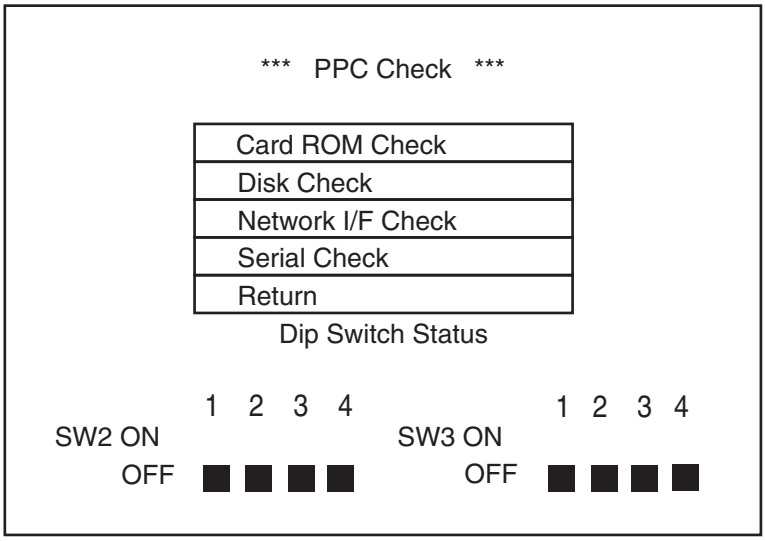
3. To return to the Diagnostic Check and System Setup screen, select the [Return] key on each Manual Check Menu screen.

4. To return to the normal patient monitoring screen, select the [Monitor Mode] key on the Diagnostic Check and System Setup screen.

PPC Check Menu Items

This PPC check menu items check the peripheral components around the CPU on the PPC board.

The following PPC check menu items are explained in the following pages.



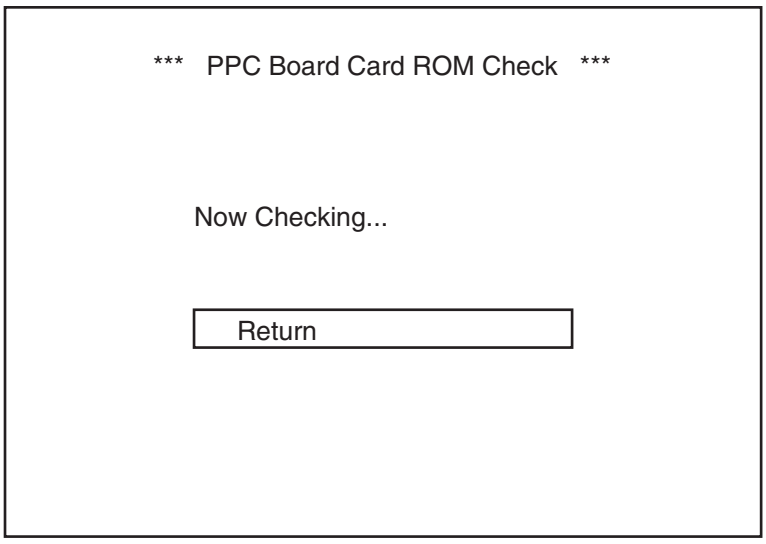
1. From the MU/VD Manual Check Menu screen, select the [PPC Check] key. The PPC Check screen appears. At the bottom of the screen, the conditions of the DIP switches SW2 and SW3 on the PPC board are displayed. All the DIP switch settings must be set to OFF.

2. From the PPC Check screen, select the check item.

3. Select the [Start] key to start the selected check item. The selected check item screen appears. Some check items automatically run if the check item is selected.

4. To return to the MU/VD Manual Check Menu screen, select the [Return] key.

Card ROM Check

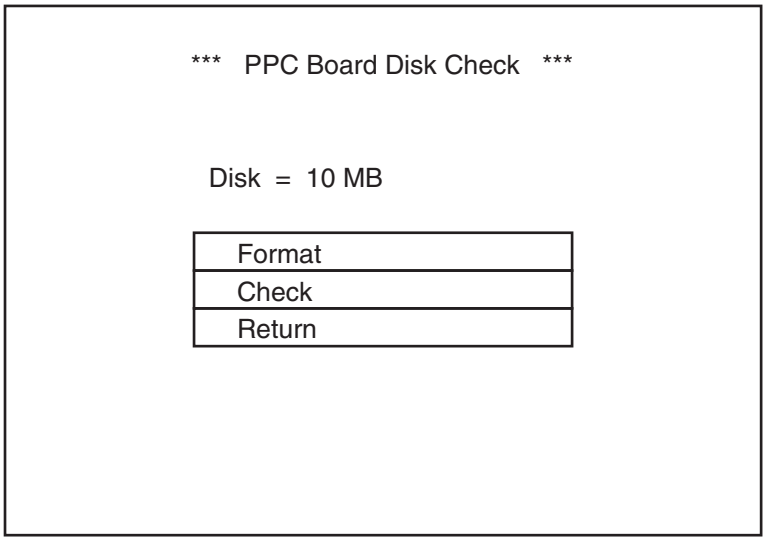


This item automatically checks the program stored in the ROM of the memory card on the PPC board by the cyclic-redundancy-check (CRC) technique. This technique compares the sum value of the stored data with the exception of the value of the last address with the prestored check sum at the last address. If the values are the same, a "CRC OK" message is displayed. If an error message is displayed, the memory card may be damaged.

Procedure to Exit the Card ROM Check

To return to the PPC Check screen, select the [Return] key.

Disk Check



This item is used to do the following:

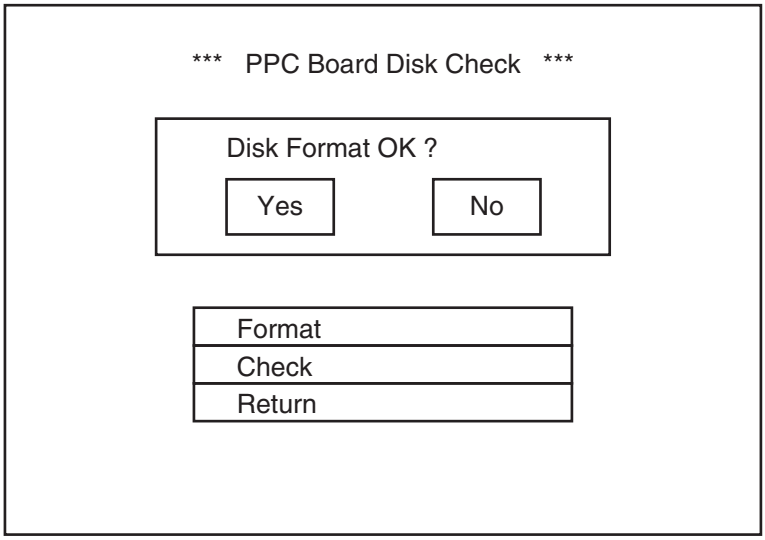
- format a flash disk card. (This format is used only in the factory.)
- check the memory in the card by comparing the test patterns that are written to the memory with the test patterns that were read from it. If there is no difference between the patterns, a "Read & Write Check is OK" message is displayed. If an error message is displayed, the flash disk card may be damaged.

CAUTION

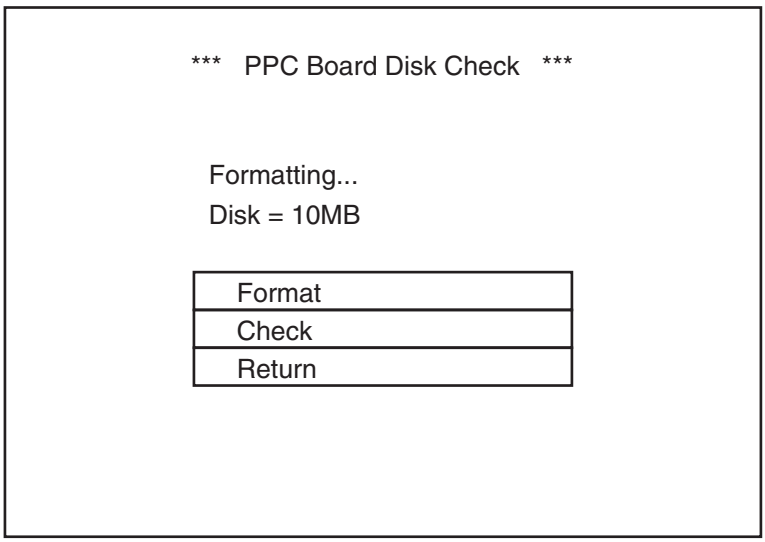
Formatting the flash disk card deletes all the stored patient data in it.

Procedure to Format a Flash Disk Card and Exit the Disk Check (only used in the factory)

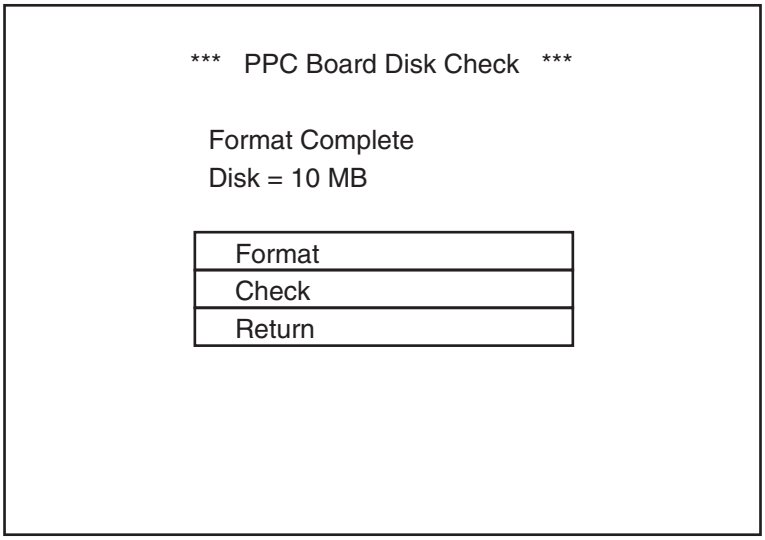
1. Select the [Format] key. A “Disk Format OK?” message appears.



2. To start formatting the card, select the [Yes] key. A “Formatting…” message appears.
   To cancel formatting the card, select the [No] key.



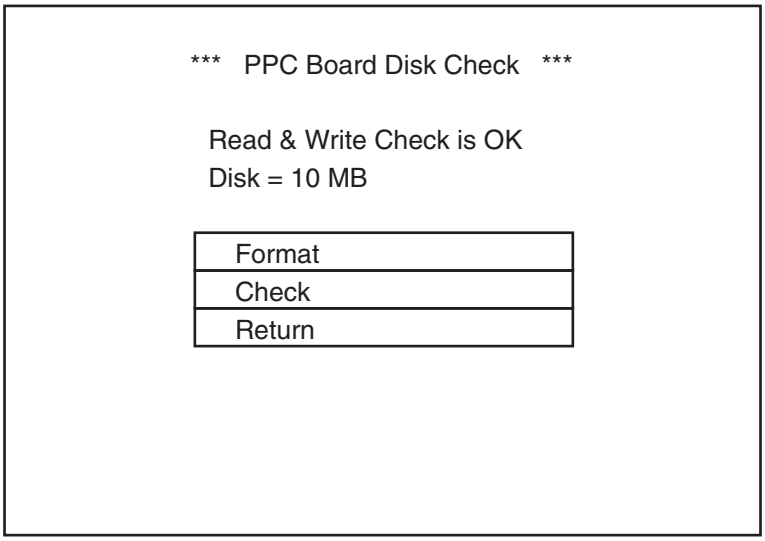
After the card is completely formatted, a “Format Complete” message appears.



3. To return to the PPC Check screen, select the [Return] key.

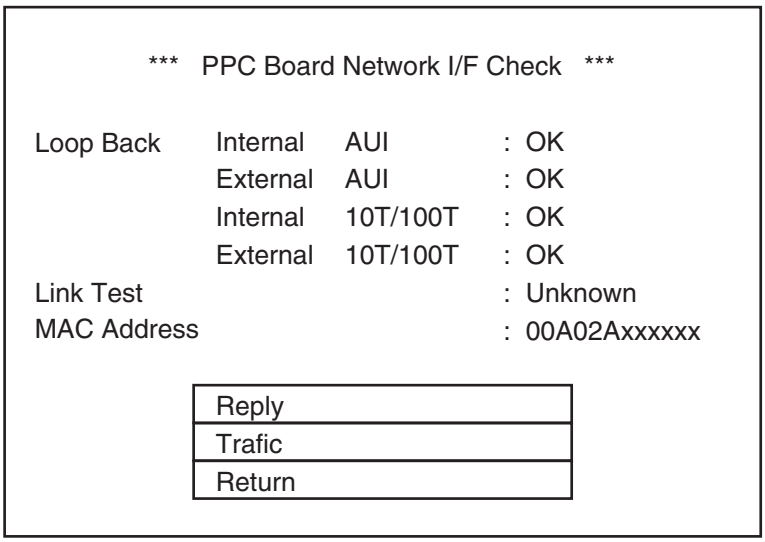
Procedure to Start and Exit the Disk Check

1. Select the [Check] key. The Flash Disk Card Memory Check automatically starts.



2. To return to the PPC Check screen, select the [Return] key.

Network I/F Check

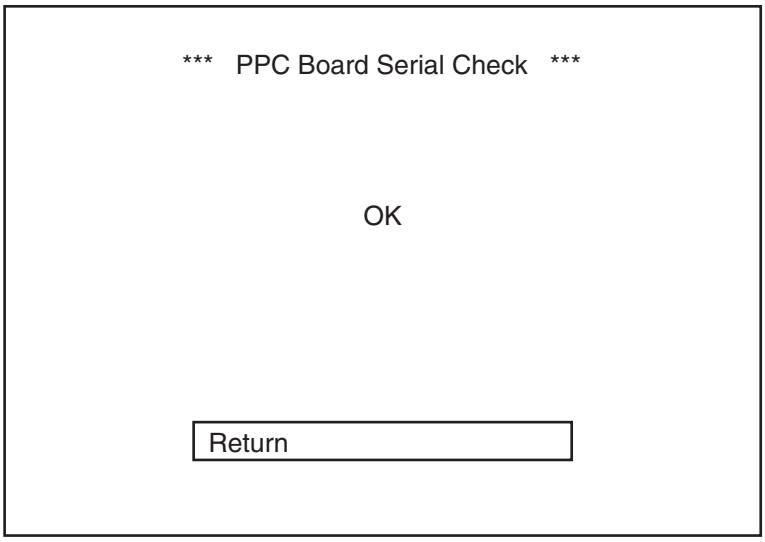


This check screen has no function.

Procedure to Exit the Network I/F Check

To return to the PPC Check screen, select the [Return] key.

Serial Check



This check is only used in the factory.

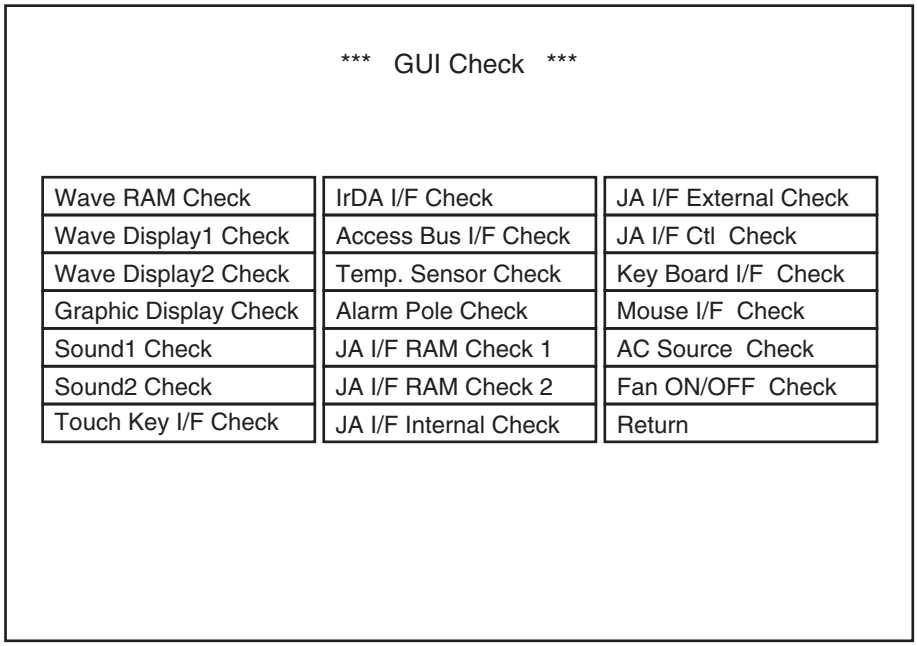
Procedure to Exit the Serial Check

To return to the PPC Check screen, select the [Return] key.

GUI Check Menu Items

The GUI check menu items are used to check the GUI board.

The following GUI check menu items are explained in the following pages.



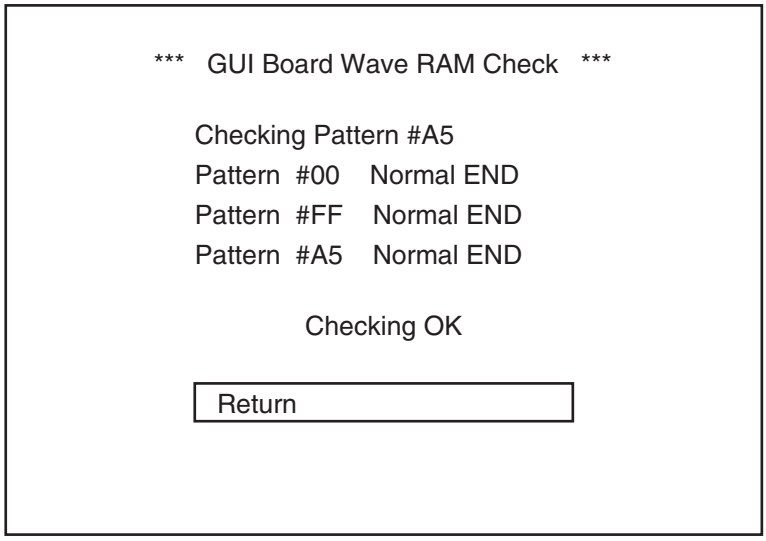
1. From the MU/VD Manual Check Menu screen, select the [GUI Check] key. The GUI Check screen appears.

2. From the GUI Check screen, select the check item.

3. Select the [Start] key to start the selected check item. The selected check item screen appears. Some check items automatically run if the check item is selected.

4. To return to the MU/VD Manual Check Menu screen, select the [Return] key.

Wave RAM Check



This item checks the RAM which is used to store the data for creating the waveform screen. The check is performed by comparing the three test patterns that are written to the RAM with the test patterns that were read from it.

If there is no difference between each written and read test pattern data, a “Normal End” message appears on the right of the test pattern name. If there is no error in this check, a “Checking OK” message is displayed. If an error is detected during check, the IC number of the faulty IC is displayed. When the IC number is displayed, the GUI board may be faulty.

Procedure to Exit the Wave RAM Check

1. To return to the GUI Check screen, select the [Return] key.

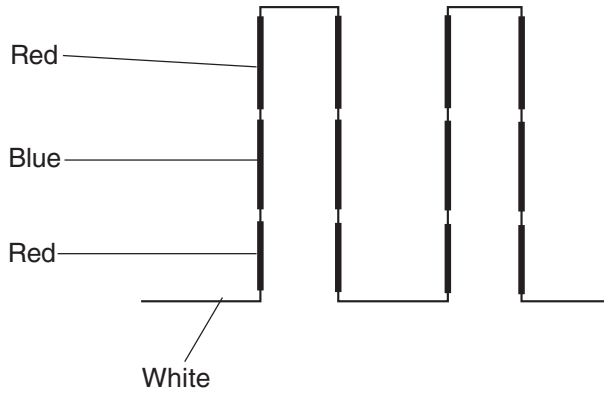
Wave Display 1 and 2 Check

NOTE

Wave Display 2 check cannot be performed on the VL-900PA color LCD unit because the display unit does not support the XGA mode.

This item checks the blocks for creating the waveform screen. The difference between Wave Display 1 and 2 checks is the display resolution. The resolution is 640 × 480 dots (VGA mode) at the Wave Display 1 and 1,024 × 768 dots (XGA mode) at the Wave Display 2.

When this check is performed on the color display unit (VD-900RA/K), the background of the screen outside the check window is black due to screen resolution difference between the color display unit (VD-900RA/K) and color LCD unit (VL-900PA).



When this item is selected, the check automatically starts and 12 rectangular waveforms are displayed on the screen. The outline of each rectangular waveform is in white and the bold lines in red and blue are superimposed on the vertical line of the rectangular waveforms as shown above.

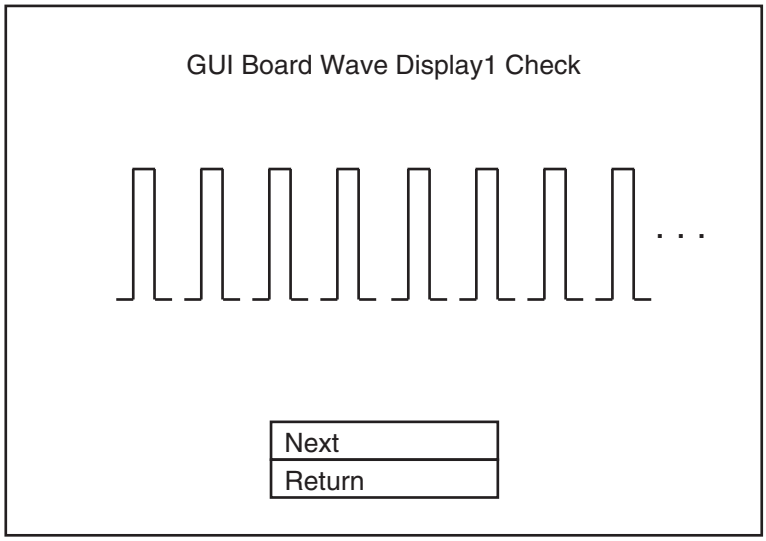
In this check, verify the following:

- Each rectangular waveform is correctly displayed without blur or distortion.
- Each rectangular waveform is correctly colored as shown above.

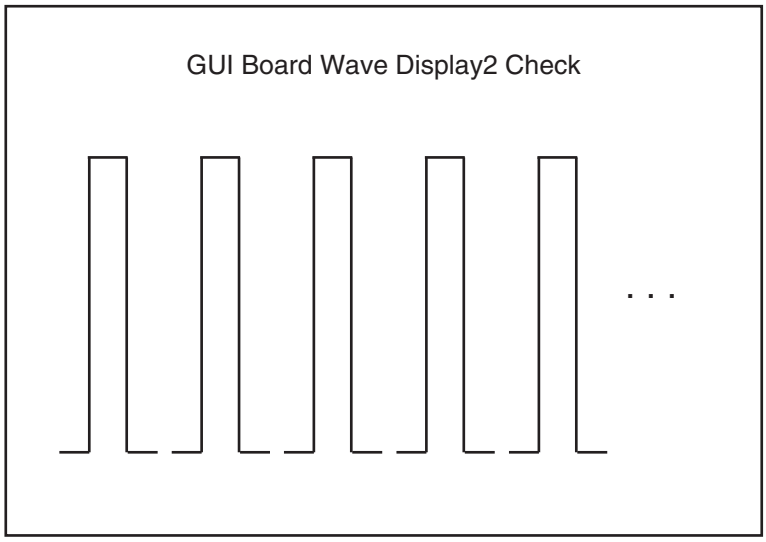
If the rectangular waveforms are not displayed correctly, the display unit may be faulty.

Procedure to Exit the Wave Display 1 Check

To return to the GUI Check screen, select the [Return] key.



Procedure to Start the Wave Display 2 Check



To start the Wave DISPLAY 2 Check, select the [Next] key on the Wave Display 1 Check screen or [Wave Display Check 2] key on the GUI Check screen. The Wave Display Check 2 screen automatically changes to the Wave Display Check 1 screen 10 seconds after the Wave Display Check 2 screen is selected.

Graphic Display Check

This item checks the blocks for creating the graphic screen. This check screen has five test patterns: four colored screens in white, red, green and blue and an H pattern character screen.

In this check, verify the following:

- The screen color and H characters are correctly displayed on the entire screen.
- The order of the test pattern is correct as described below.

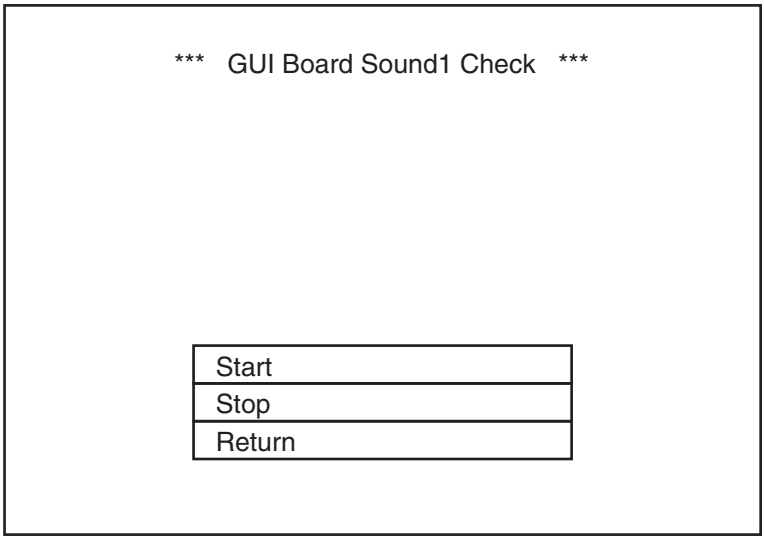
If both of the above are not satisfied, the display unit may be faulty.

Procedure to Check and Exit the Graphic Display Check

Press the NIBP INTERVAL key repeatedly to change the test pattern as follows.

White color ⇒ Red color ⇒ Green color ⇒ Blue color ⇒ H characters ⇒ GUI Check screen

Sound 1 Check

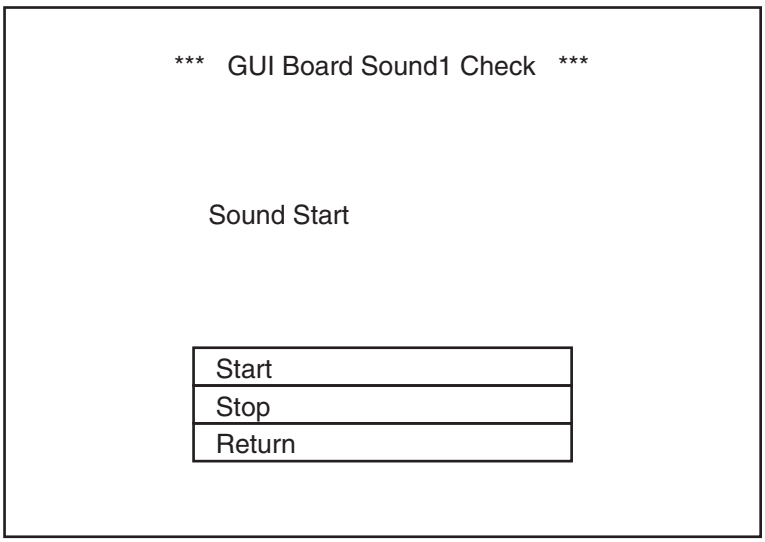


This item checks the FM sound source and the amplifier of the speaker circuit on the GUI board by generating the alarm sound.

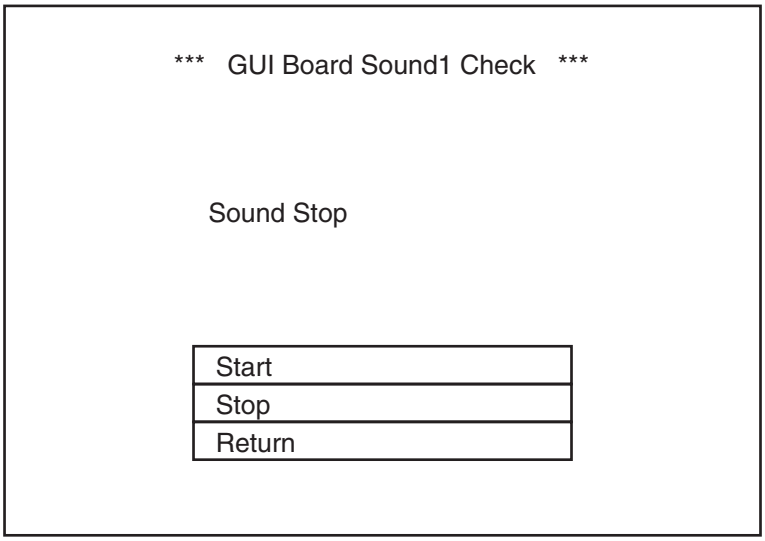
If there is no sound, the GUI board may be faulty.

Procedure to Start, Stop and Exit the Sound 1 Check

1. To start the Sound1 check, select the [Start] key. The following screen appears.

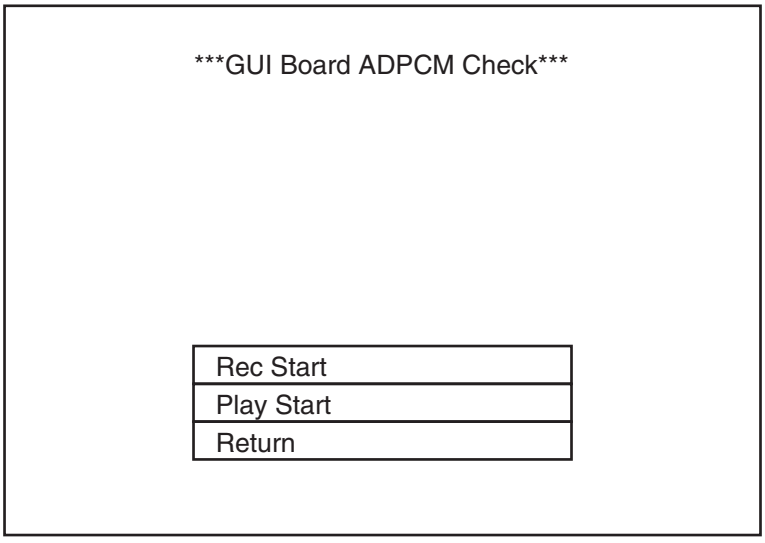


2. To stop the Sound 1 check, select the [Stop] key. The following screen appears.



3. To return to the GUI Check screen, select the [Return] key.

Sound 2 Check

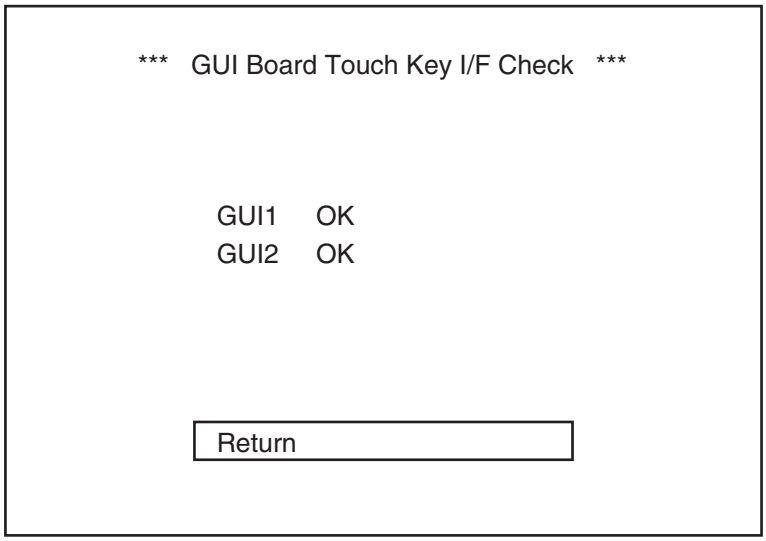


This check screen has no function.

Procedure to Exit the Sound 2 Check

To return to the GUI Check screen, select the [Return] key.

Touch Key I/F Check

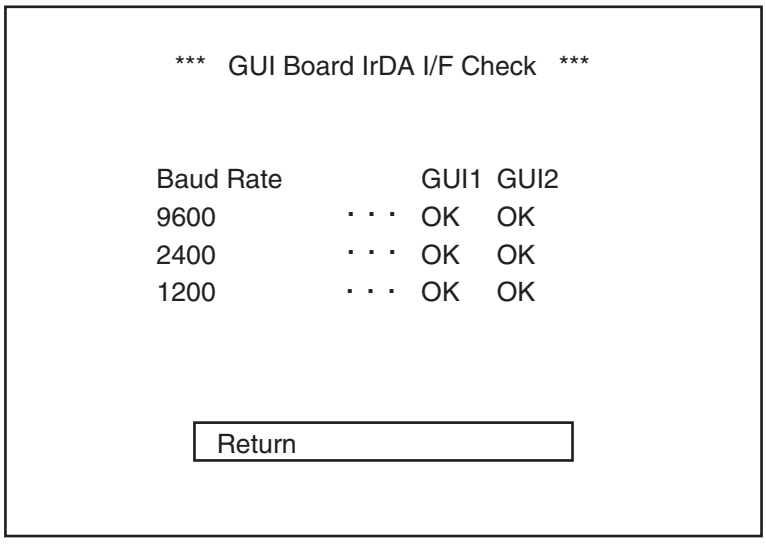


This check is only used in the factory.

Procedure to Exit the Touch Key I/F Check

To return to the GUI Check screen, select the [Return] key.

IrDA I/F Check

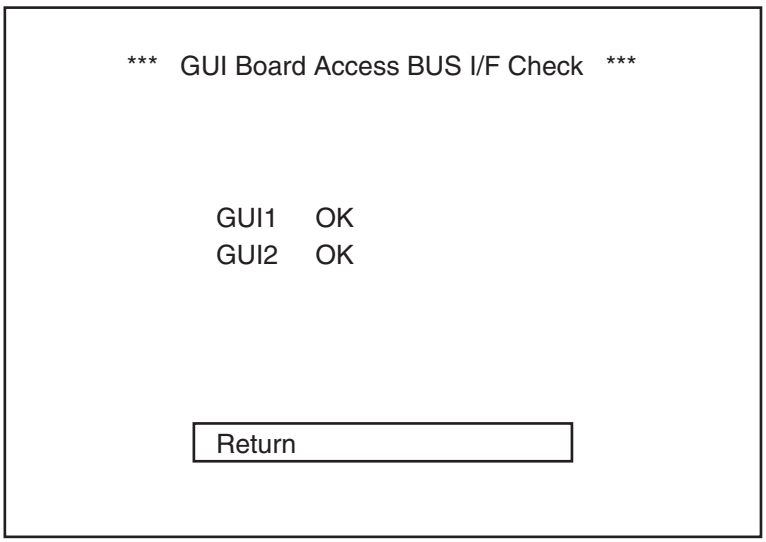


This check is only used in the factory.

Procedure to Exit the IrDA I/F Check

To return to the GUI Check screen, select the [Return] key.

Access Bus I/F Check

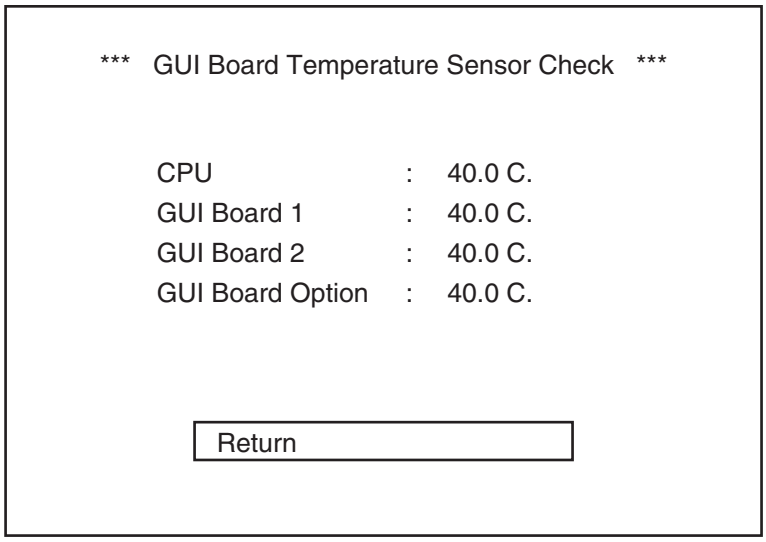


This item checks the communication between the GUI board and VD-900RA/K color display unit connected to the main unit by transferring the test data between the main unit and color display unit. If there is no communication error, an “OK” message is displayed to the right of “GUI1” and “GUI2”. The “GUI1” is for the standard GUI board and the “GUI2” is for the optional GUI board. If there is a communication error or the color display unit is not connected to the main unit, an “NG” message is displayed.

Procedure to Exit the BUS I/F Check

To return to the GUI Check screen, select the [Return] key.

Temperature Sensor Check



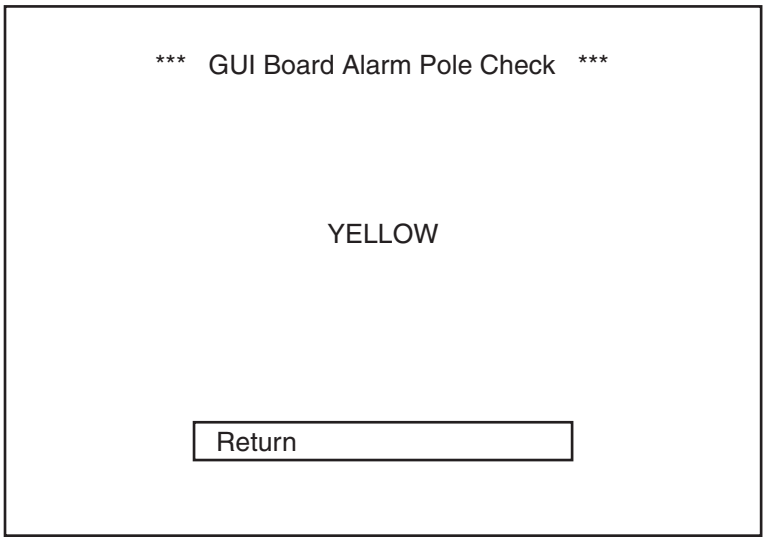
This item checks the temperature on each board in the main unit.

This check should be performed when the “CHANGE FILTER” message frequently appears on the screen even after the filter is cleaned or replaced with a new one. At the right of the “CPU”, “GUI Board1”, “GUI Board2” and “GUI Board Option”, the temperature test results of the PPC board, standard GUI board, optional GUI board and a future board (no plan at this time) are displayed, respectively. This information allows you to fix problems with the temperature sensor circuit.

Procedure to Exit the Temperature Sensor Check

To return to the GUI Check screen, select the [Return] key.

Alarm Pole Check



This item checks the operation of the red, yellow and green LEDs of the alarm pole and alarm pole interface. When the alarm pole is connected, the alarm pole lights according to the color of the message on the screen. The color changes as follows until the [Return] key is selected.

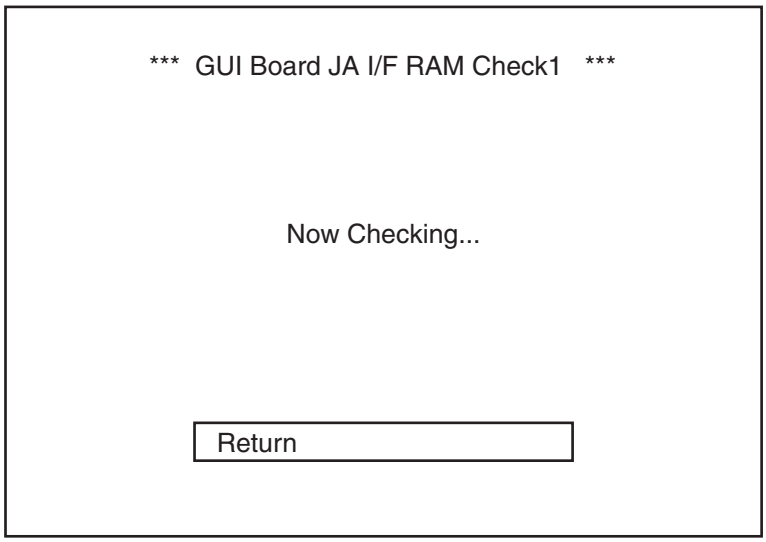
Red ⇒ Yellow ⇒ Green ⇒ Red ⇒ ……

If the alarm pole does not light according to the color of the message on the screen, the alarm pole or GUI board may be faulty.

Procedure to Exit the Alarm Pole Check

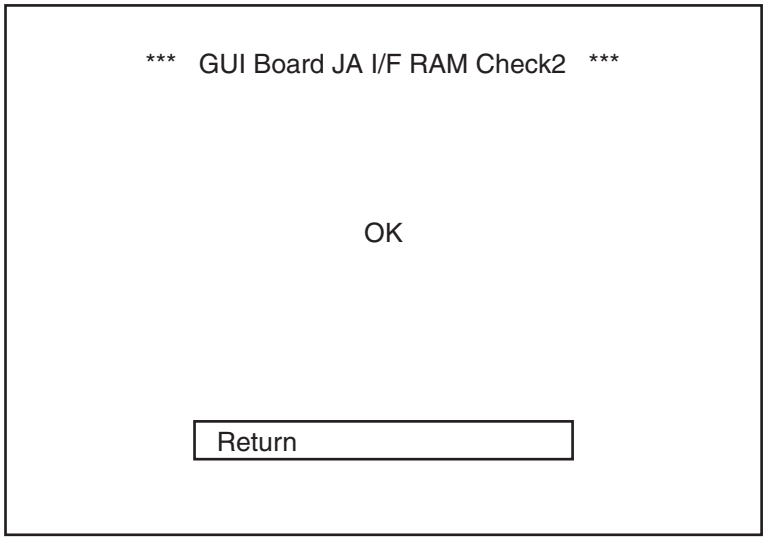
To return to the GUI Check screen, select the [Return] key.

JA I/F RAM Check 1 and 2



This item checks the RAMs on the GUI board which stores the data transferred and received between the main unit and input box. This check is performed by comparing the test patterns that are written on the RAMs with the test patterns that were read from the RAMs. The difference between the JA I/F RAM Check 1 and 2 is the checked addresses of the RAMs.

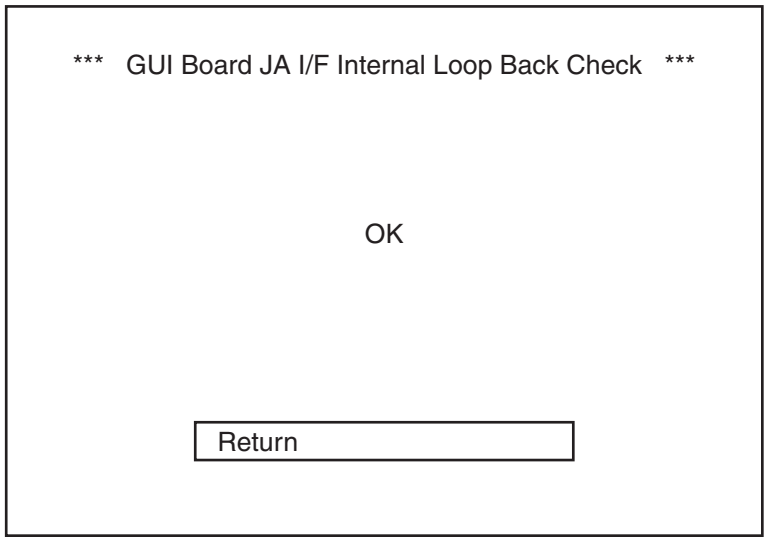
If each check item is selected, the JA I/F RAM check automatically starts and the "Now Checking…" message appears. If the check is successfully completed, a "OK" message is displayed. If an error message is displayed, the GUI board may be faulty.



Procedure to Exit the JA I/F RAM Check 1 and 2

To return to the GUI Check screen, select the [Return] key.

JA I/F Internal Loop Back Check

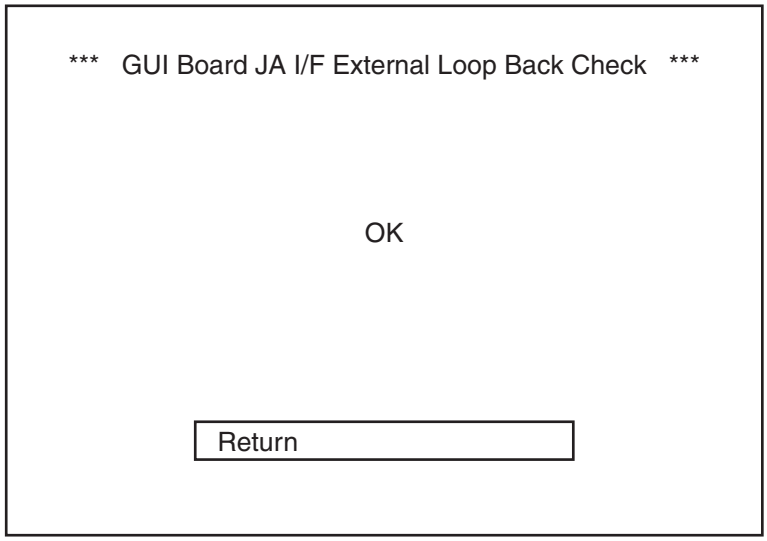


This item checks the communication between the JA interface on the GUI board and the ROMs on the GUI board.

If this check is successfully completed, an “OK” message is displayed. If an error message is displayed, the GUI board may be faulty.

Procedure to Exit the JA I/F Internal Loop Back Check
To return to the GUI Check screen, select the [Return] key.

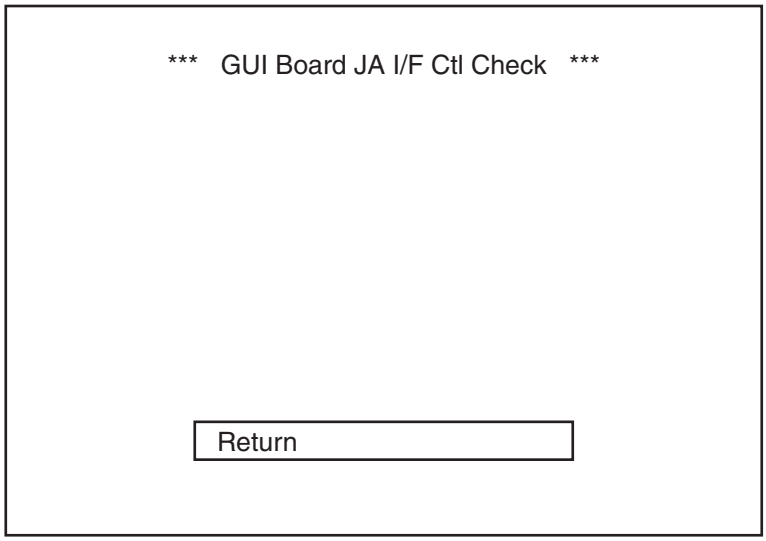
JA I/F External Loop Back Check



This item is only used in the factory.

Procedure to Exit the JA I/F External Loop Back Check
To return to the GUI Check screen, select the [Return] key.

JA I/F Ctl Check

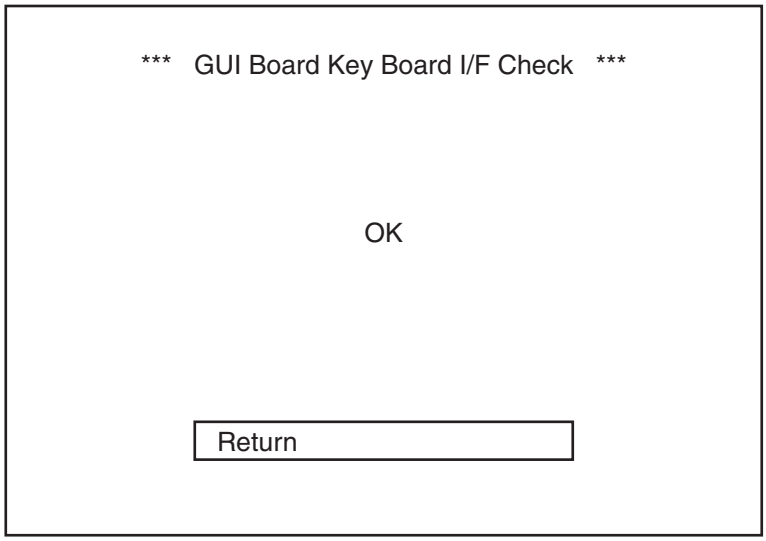


This item is only used in the factory.

Procedure to Exit the JA I/F Ctl Check

To return to the GUI Check screen, select the [Return] key.

Keyboard I/F Check



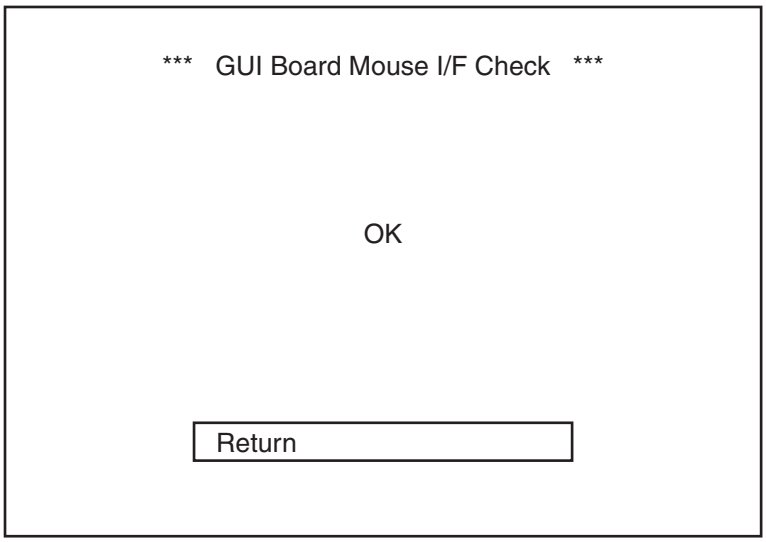
This item checks the keyboard interface on the GUI board when the keyboard is connected to the main unit.

If this check is successfully completed, an “OK” message is displayed. If an error message is displayed, the GUI board may be faulty.

Procedure to Exit the Keyboard I/F Check

To return to the GUI Check screen, select the [Return] key.

Mouse I/F Check

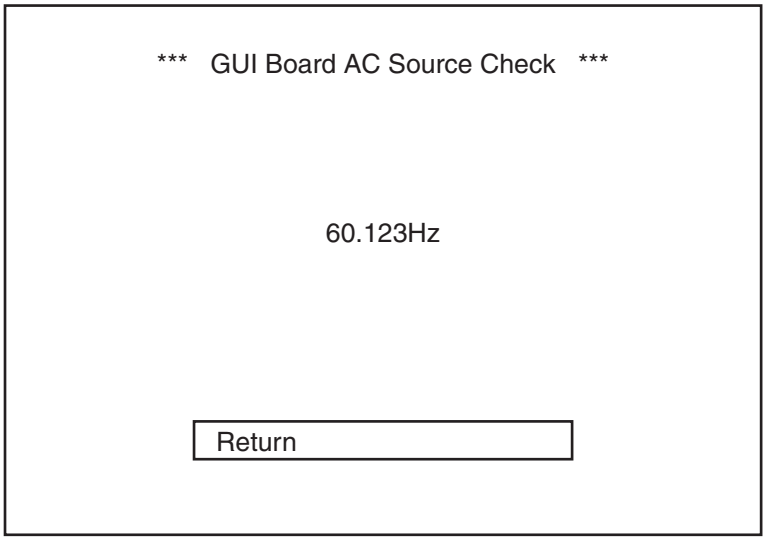


This item checks the mouse interface on the GUI board when the mouse is connected to the main unit.

If this check is successfully completed, an “OK” message is displayed. If an error message is displayed, the GUI board may be faulty.

Procedure to Exit the Mouse I/F Check
To return to the GUI Check screen, select the [Return] key.

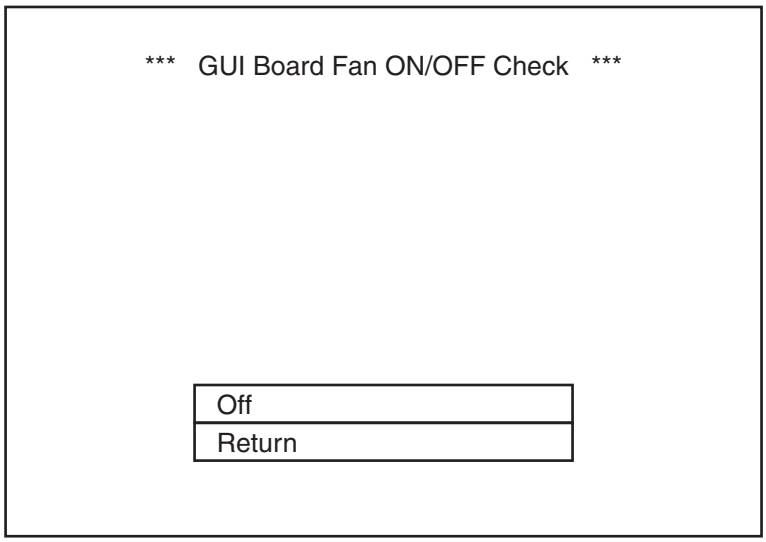
AC Source Check



This item checks the line frequency detection circuit on the GUI board. If the detected line frequency is ±10% out of the line frequency, the GUI board may be faulty or the supplied power may be unstable.

Procedure to Exit the AC Source Check
To return to the GUI Check screen, select the [Return] key.

Fan ON/OFF Check

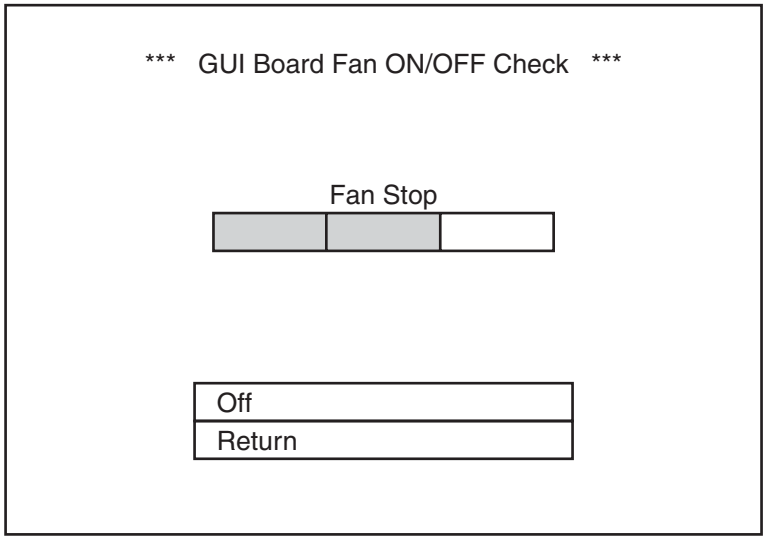


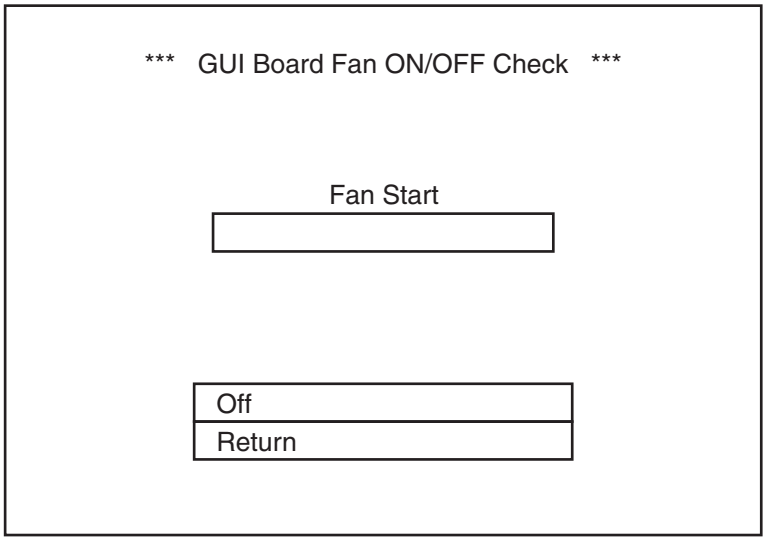
This item checks whether or not the fan in the main unit starts/stops rotating correctly.

If the fan does not work according to the routine described below, the GUI board may be faulty.

Procedure Start and Exit the Fan On/Off Check

1. Select the [Off] key. The fan automatically stops rotating for 3 seconds. After each one second elapses, a yellow bar indicator lights up on the screen until three seconds elapses. (For example, two lightning yellow indicators indicate that two seconds has elapsed after the fan stops rotating.). 3 seconds after the fan stops rotating, it automatically starts rotating and the “Fan Start” message appears.





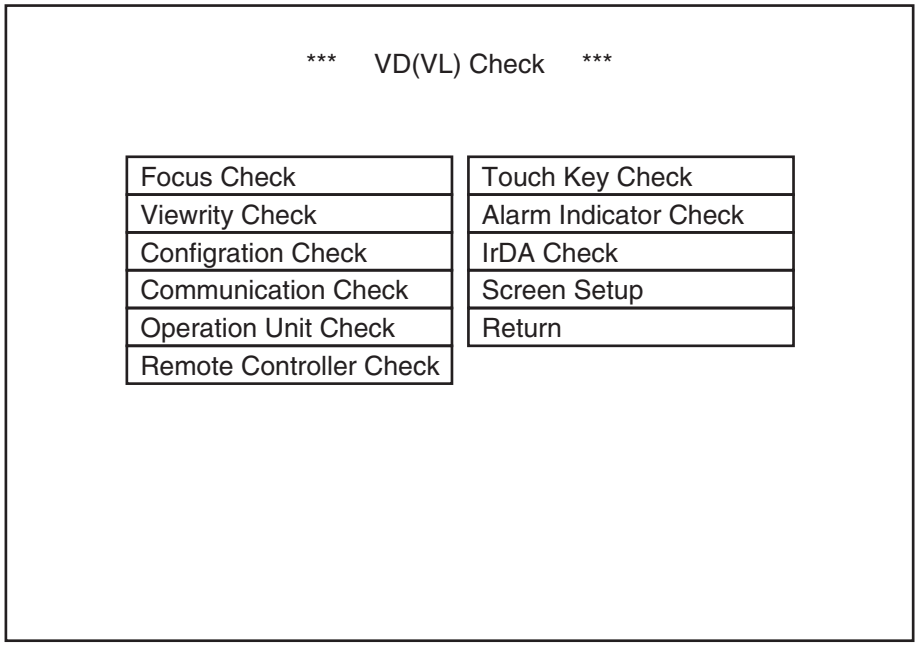
2. To return to the GUI Check screen, select the [Return] key.

VD(VL) Check Menu Items

This VD(VL) check menu items check the VD-900RA/K color display unit or VL-900PA/VL-910RA color LCD unit. These two monitors can be connected to the same main unit together when an optional GUI board is installed. However, the VD(VL) check menu items cannot be simultaneously performed on two monitors.

In the illustrations and text of this section, “VD(VL)” is shown or written. However, the word “VD(VL)” is not actually displayed in the window name and key name. When the VD-900RA/K color display unit is checked, only “VD” appears: when the VL-900PA/VL-910RA color LCD unit is checked, only “VL” appears.

The following VD(VL) check menu items are explained in the following pages.



1. From the MU/VD Manual Check Menu screen, select the [VD(VL) Check] key. The VD(VL) Check screen appears.

2. From the VD(VL) Check screen, select the check item.

3. Select the [Start] key to start the selected check item. The selected check item screen appers. Some check items automatically run if the check item is selected.

4. To return to the MU/VD Manual Check Menu screen, select the [Return] key.

Focus Check

This item checks the screen focus of the display unit.

If this item is selected, the entire display screen has a black background color and is filled with “H” characters. If the “H” characters are not clearly and completely displayed on the entire display screen, the display unit may be faulty.

Procedure to Exit the Focus Check
To return to the VD(VL) Check screen, select the NIBP INTERVAL key.

Viewrity Check (Graphic display check)

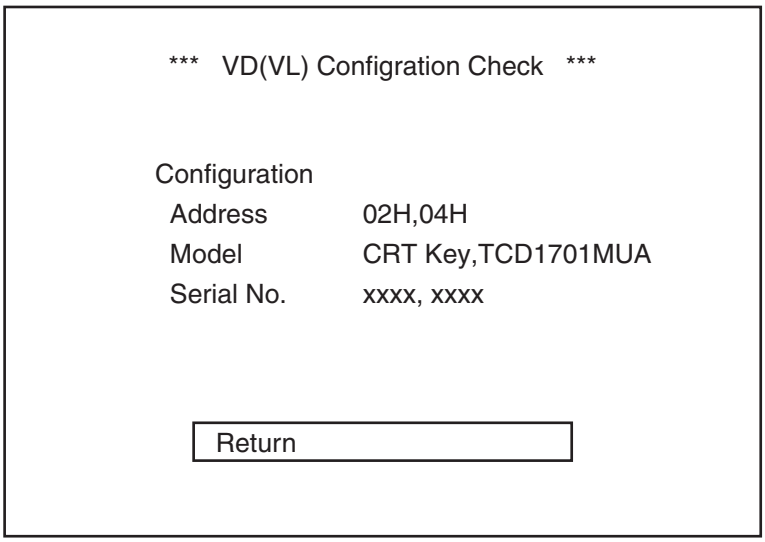
This item checks the graphic display format.

Procedure to Perform the Viewrity Check
To change the check screen, select the NIBP INTERVAL key. Every time the key is pressed, the check screen changes as follows:
white color screen ⇒ red color screen ⇒ green color screen ⇒ blue color screen ⇒ grid pattern screen ⇒ VD(VL) Check screen

In this check, verify the following:
- The screen color is correctly displayed on the entire screen.
- The order of the test pattern is correct as described above.

If the above conditions are not satisfied, the display unit may be faulty.

Configuration Check

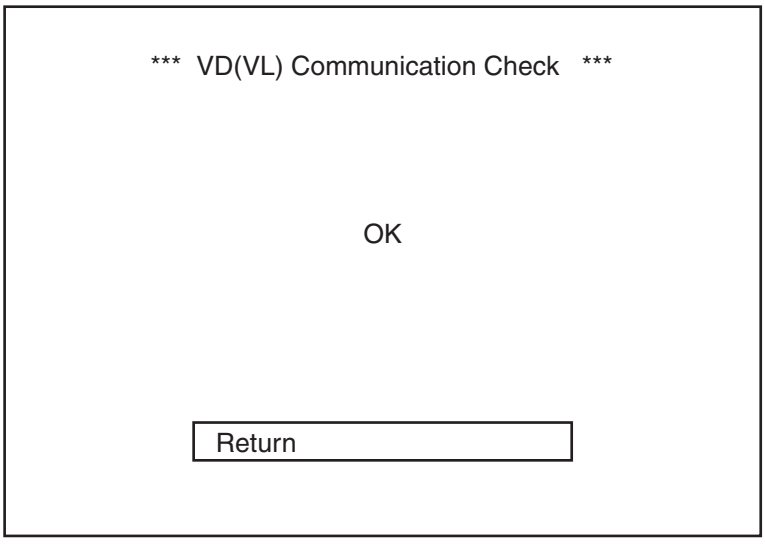


This item displays the address, model and serial number of the checked display unit. This information allows you to fix problems with the display unit.

Procedure to Exit the Configuration Check

To return to the VD(VL) Check screen, select the [Return] key.

Communication Check



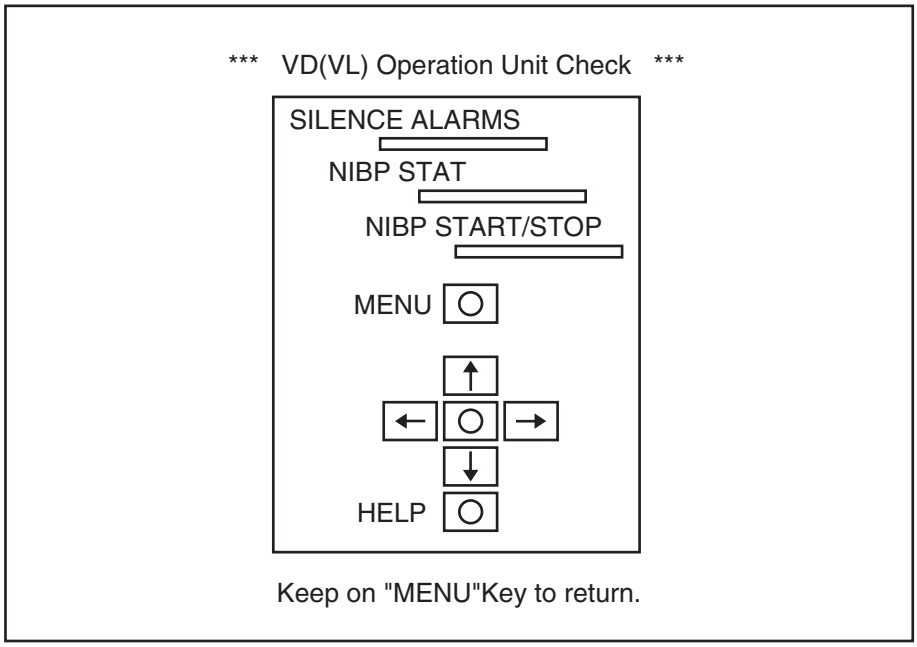
This item checks the communication between the main unit and display unit.

If there is no communication error, the “OK” message appears. If an error message is displayed, the display unit may be faulty.

Procedure to Exit the Communication Check

To return to the VD(VL) Check screen, select the [Return] key.

Operation Unit Check



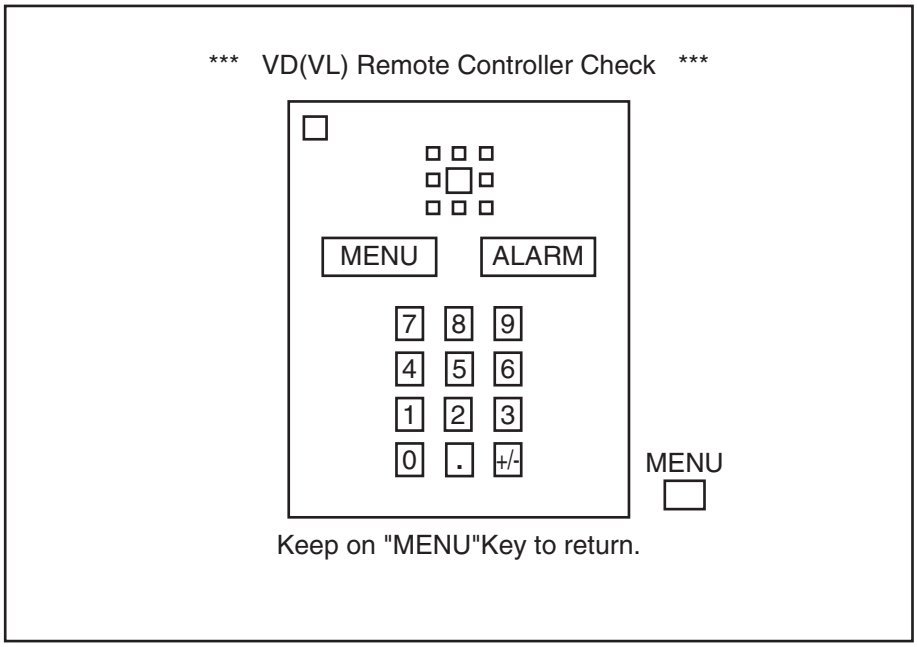
This item checks the key operation of the control panel on the display unit. A diagram of the key location on the control panel is displayed on the screen. When any key on the control panel is pressed, the corresponding pressed key on the screen is usually reverse shaded yellow.

Procedure to Check the Keys or to Exit the Operation Unit Check
To check the key on the control panel, press the key and confirm that the corresponding pressed key is reverse shaded yellow.

If the pressed key is not reverse shaded yellow, the key may be faulty. However, if more than one key has this symptom, the control panel may be faulty.

To return to the VD(VL) Check screen, press and hold the MENU key on the control panel.

Remote Controller Check



This item checks the key operation of the remote control. A diagram of the key location on the remote control is displayed on the screen. When any key on the remote control is pressed, the corresponding pressed key is reverse shaded yellow. However, the only exception to this case is the Power switch on the remote control. When this key is pressed, the power of the display unit is turned off.

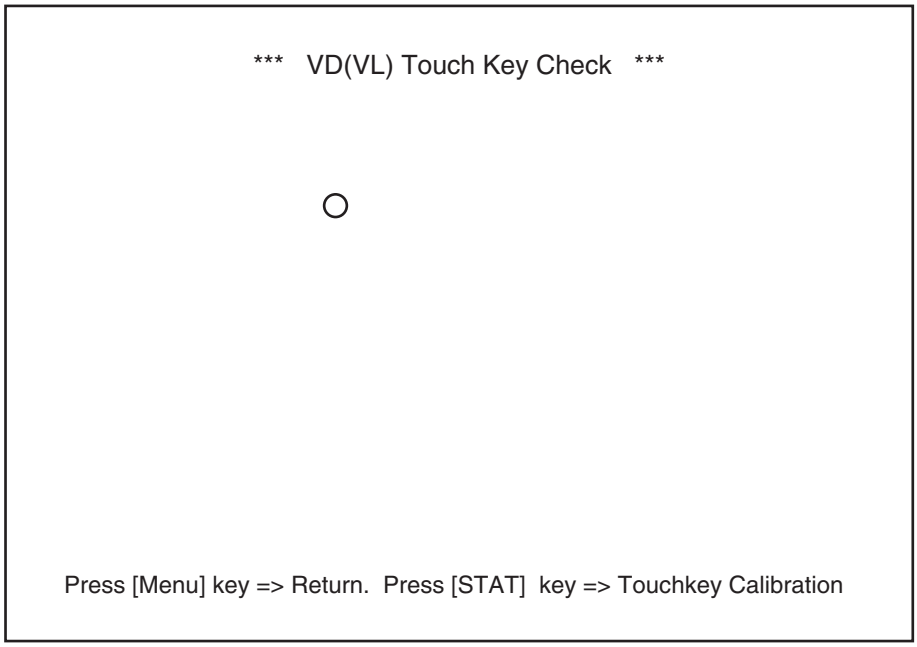
Procedure to Check the Keys or to Exit the Remote Controller Check

To check the key on the remote control, press the key and confirm that the corresponding pressed key is reverse shaded yellow.

If the pressed key is not reverse shaded yellow, the key may be faulty. However, if more than one key has this symptom, the remote control may be faulty.

To return to the VD(VL) Check screen, press and hold the MENU key on the remote control.

Touch Key Check



This item checks the touch key operation of the touch screen. The touched touch screen point is indicated by a yellow circle.

Procedure to Check the Touch Keys, Call up the Touch Key Calibration Screen or Exit the Touch Check

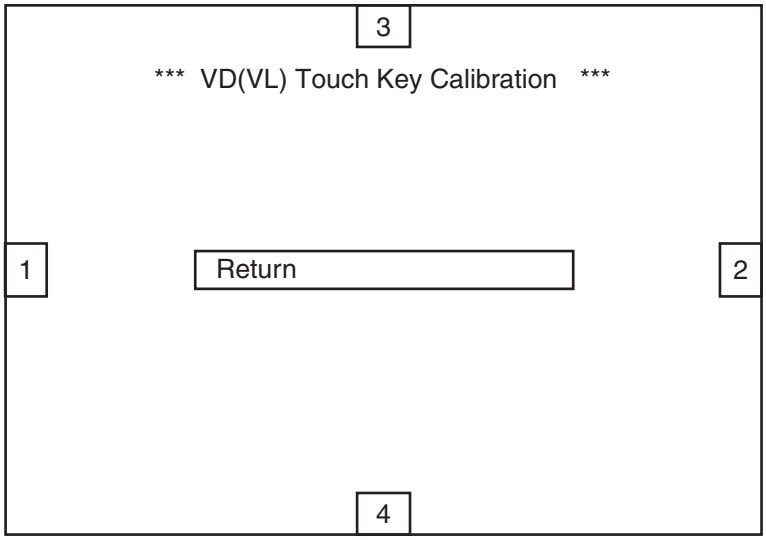
To check the touch keys on the touch screen, touch the screen and confirm that the corresponding touched position is indicated by a yellow circle.

If the touched position is not correctly marked with an yellow circle, calibrate the touch screen (See the next section to calibrate the touch screen.). If this symptom remains after re-calibration, the touch screen may be faulty.

To call up the Touch Key Calibration screen to calibrate the touch screen from the Touch Key Check screen, press and hold the NIBP INTERVAL key on the control panel or remote control.

To return to the VD(VL) Check screen, press and hold the MENU key on the control panel or remote control.

Touch Key Calibration



This item calibrates the touch screen. Pressing the 4 white points displayed at the top, bottom, right and left of the screen re-calibrates the touch screen correctly. However, even if the 4 points are pressed correctly, there is no confirmation sound or display message, etc., to indicate that the touch screen is calibrated.

Procedure to Perform and Exit the Touch Key Calibration

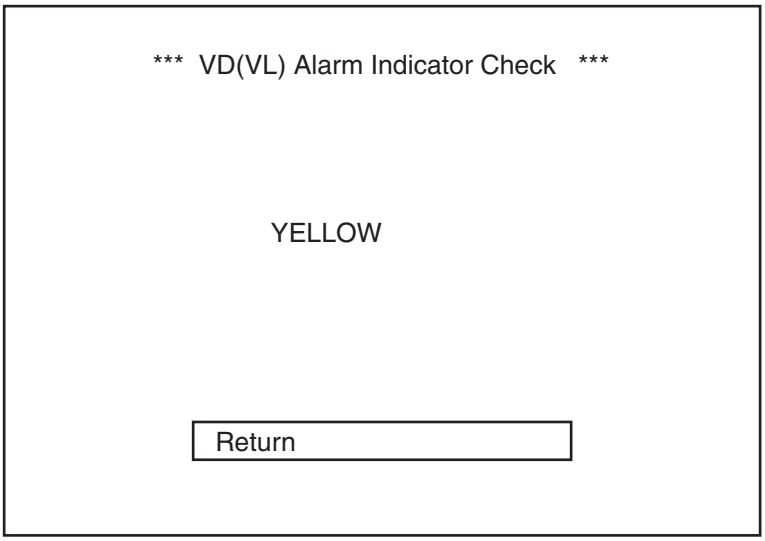
1. Select the Touch Key Check screen from the VD(VL) Check screen. The Touch Key Check screen is called up.

2. To call up the Touch Key Calibration screen, press and hold down the NIBP INTERVAL key on the control panel or remote control from the Touch Key Check screen. The Touch Key Calibration screen appears and the four white touch points at the top, bottom, right and left of the screen are displayed.

3. To calibrate the touch screen, touch the four touch points.

To return to the Touch Key Check screen, select the [Return] key.

Alarm Indicator Check



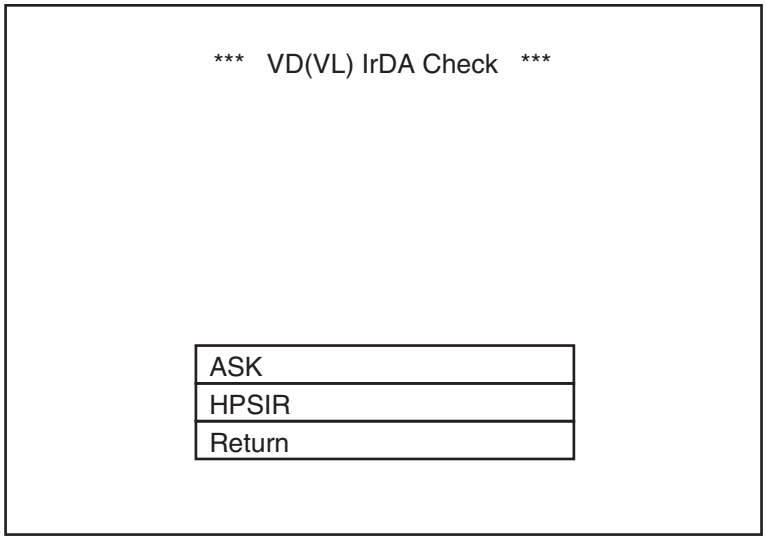
This item checks the alarm indicator on the display unit.

If this item is selected, the Alarm Indicator check automatically starts. The alarm indicator lights according to the color of the message displayed on the screen in the following order.
RED ⇒ YELLOW ⇒ RED ...

If the alarm pole does not light, the alarm indicator may be faulty.

Procedure to Stop and Exit the Alarm Indicator Check
To stop the Alarm Indicator check and return to the VD(VL) Check screen, select the [Return] key.

IrDA Check



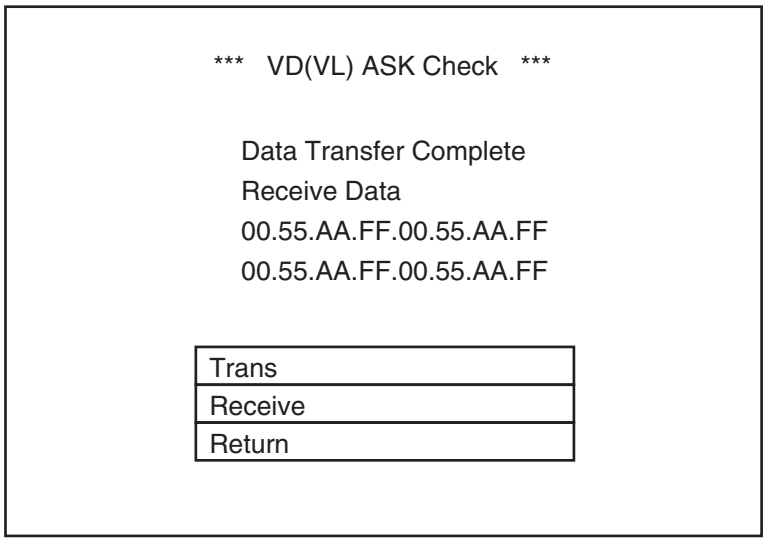
This check is only used in the factory.

Procedure to Call up the ASK Check Screen or HRSIR Check Screen, or Exit the IrDA Check

To call up the ASK Check screen, select the [ASK] key.
To call up the HPSIR Check screen, select the [HPSIR] key.

To return to the VD(VL) Check screen, select the [Return] key.

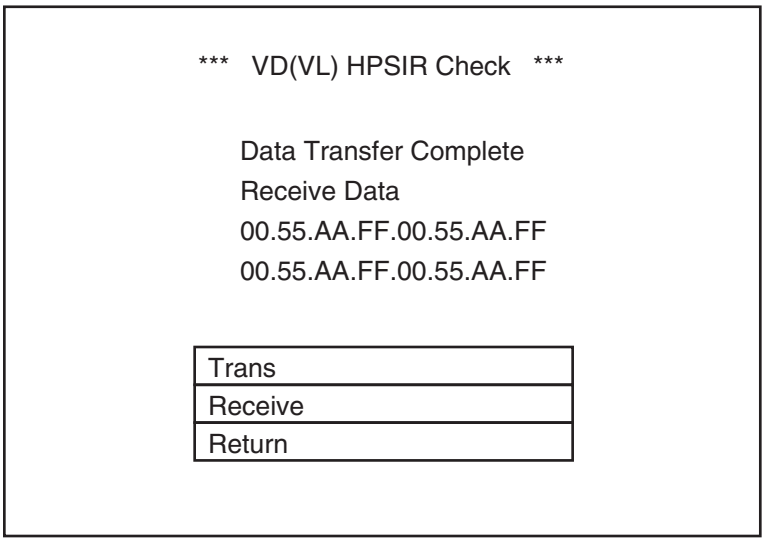
ASK Check



This check is only used in the factory.

Selecting the [Return] key on the ASK Check screen returns to the IrDA Check screen. To return to the VD(VL) Check screen, select the [Return] key on the IrDA Check screen.

HPSIR Check



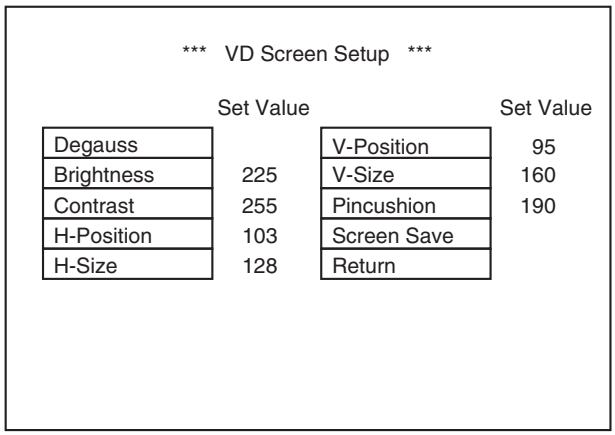
This check is only used in the factory.

Selecting the [Return] key on the HPSIR Check screen returns to the IrDA Check screen. To return to the VD(VL) Check screen, select the [Return] key on the IrDA Check screen.

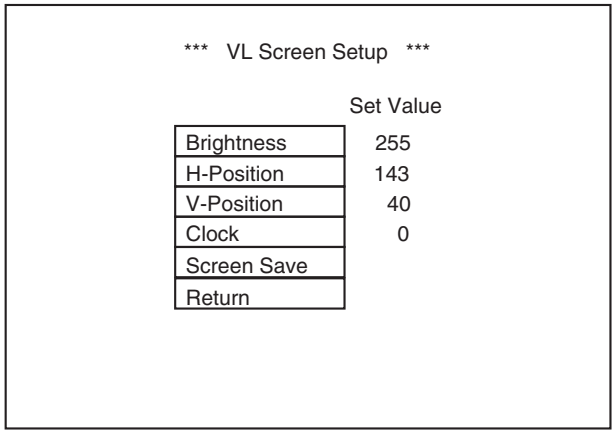
Screen Setup

This item calls up the Brightness, Contrast, H-Position, H-Size, V-Position, V-Size, Pincushion, Clock setting screen, Degauss screen and Screen Save screen. The check screens which can be called up are different according to the display unit, as shown below.

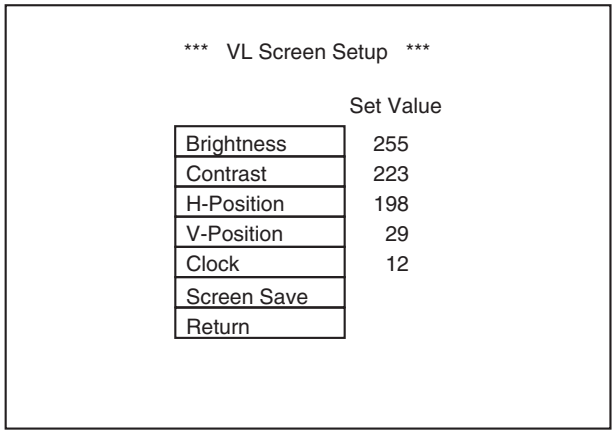
When using VD-900RA/RK color display unit



When using VL-900PA color LCD unit



When using VL-910RA color LCD unit

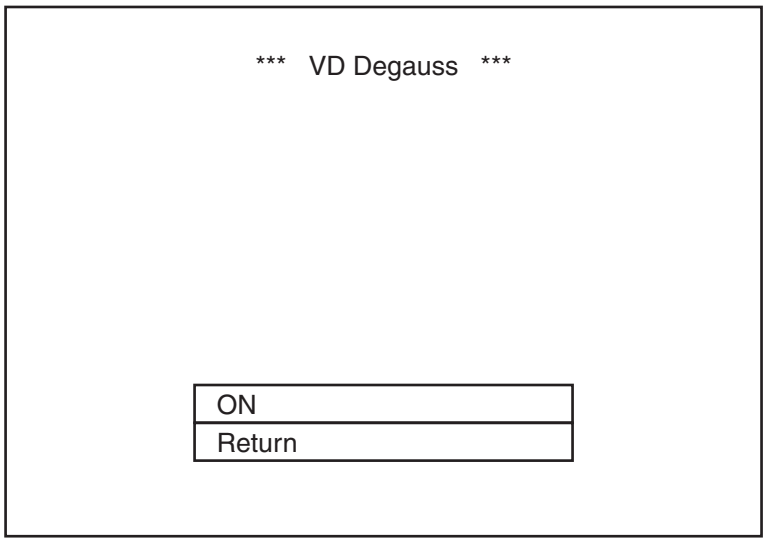


Procedure to Call up Each Screen or Exit the Screen Setup

To call up each screen, select the corresponding key.

To return to the VD(VL) Check screen, select the [Return] key.

Degauss



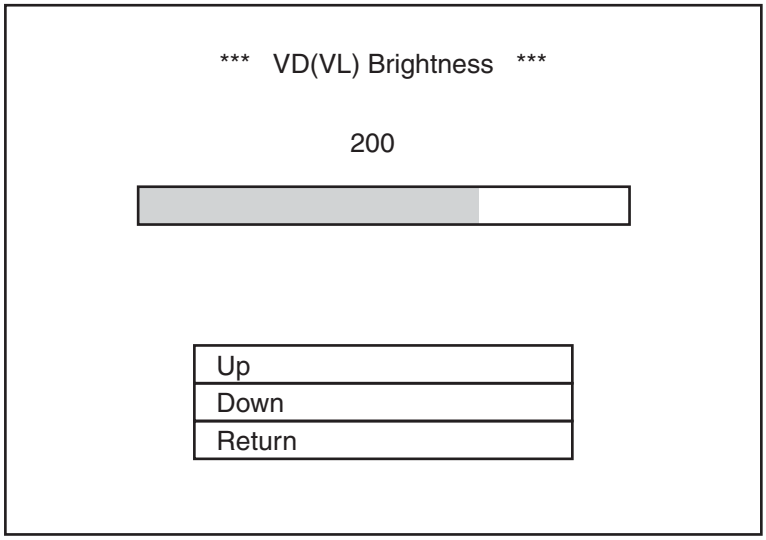
This item eliminates possible color shading or impurity on the display screen.

Procedure to Perform or Exit the Degauss

To eliminate the possible color shading or impurity on the screen, select the [ON] key.

To return to the Screen Setup screen, select the [Return] key. To return to the VD(VL) Check screen, select the [Return] key.

Brightness



This item adjusts the brightness of the screen. The currently set screen brightness value is displayed at the right of the [Brightness] key on the Screen Setup screen. On the Brightness screen, the currently set brightness value is indicated by the number and indication bar. The factory initial setting value of the screen brightness is 225 on the VD-900RA/RK and 255 on the VL-900PA and VL-910RA respectively.

Procedure to Adjust the Brightness, Save the Changed Setting, or Exit the Brightness

To increase the brightness of the screen by one, press the [Up] key once. If the [Up] key is selected and held down, the brightness value increases.
To decrease the brightness of the screen by one, press the [Down] key once. If the [Down] key is selected and held down, the brightness value decreases.

To save the changed setting, return to the Screen Setup screen, call up the Screen Save screen then perform the Screen Save steps. See the “Screen Save” section.

To return to the Screen Setup screen, select the [Return] key, then to return to the VD(VL) Check screen, select the [Return] key.

Contrast

This item adjusts the contrast of the screen. The currently set screen contrast value is displayed at the right of the [Contrast] key on the Screen Setup screen. On the Contrast screen, the currently set screen contrast value is indicated by the number and indication bar. The factory initial setting value of the screen contrast is 255 on the VD-900RA/RK and 223 on the VL-910RA respectively.

Procedure to Adjust the Contrast, Save the Changed Setting, or Exit the Contrast

To increase the contrast of the screen by one, press the [Up] key once. If the [Up] key is selected and held down, the contrast value increases.
To decrease the contrast of the screen by one, press the [Down] key once. If the [Down] key is selected and held down, the contrast value decreases.

To save the changed setting, return to the Screen Setup screen, call up the Screen Save screen then perform the Screen Save steps. See the “Screen Save” screen.

To return to the Screen Setup screen, select the [Return] key, then to return to the VD(VL) Check screen, select the [Return] key.

H-Position

This item adjusts the horizontal position of the image on the display screen. The currently set horizontal position value is displayed at the right of the [H-Position] key on the Screen Setup screen. On the Horizontal Position screen, the currently set horizontal position value is indicated by the number and indication bar. The factory initial setting value of the horizontal position is 103* on the VD-900RA/RK, 143 on the VL-900PA and 198 on the VL-910RA respectively.

* This is a typical value. This value depends on each VD-900RA/RK color display unit.

Procedure to Adjust the H-Position, Save the Changed Setting, or Exit the H-Position

To move the image on the screen to the right or left, select and hold down the [Right] or [Left] key.

To save the changed setting, return to the Screen Setup screen, call up the Screen Save screen then perform the Screen Save steps. See the “Screen Save” section.

To return to the Screen Setup screen, select the [Return] key, then to return to the VD(VL) Check screen, select the [Return] key.

H-Size

This item adjusts the horizontal size of the image on the display screen. The currently set horizontal image size value is displayed at the right of the [H-Size] key on the Screen Setup screen. On the Horizontal Size screen, the currently set horizontal size value is indicated by the number and indication bar. The factory initial setting value of the horizontal size is 128 on the VD-900RA/RK.

Procedure to Adjust the H-Size, Save the Changed Setting, or Exit the H-Size
To increase the width of the image on the screen, select and hold down the [Expand] key.
To decrease the width of the image on the screen, select and hold down the [Narrow] key.

To save the changed setting, return to the Screen Setup screen, call up the Screen Save screen, then perform the Screen Save steps. See the “Screen Save” section.

To return to the Screen Setup screen, select the [Return] key, then to return to the VD(VL) Check screen, select the [Return] key.

V-Position

This item adjusts the vertical position of the image on the display screen. The currently set vertical image position value is displayed at the right of the [V-Position] key on the Screen Setup screen. On the Vertical Position screen, the currently set vertical position value is indicated by the number and indication bar. The factory initial setting value of the vertical position is 95* on the VD-900RA/RK, 40 on the VL-900PA and 29 on the VL-910RA respectively.
* This is a typical value. This value depends on each VD-900RA/RK color display unit.

Procedure to Adjust the V-Position, Save the Changed Setting, or Exit the V-Position
To move the image on the screen up, select and hold down the [Upper] key.
To move the image on the screen down, select and hold down the [Lower] key.

To save the changed setting, return to the Screen Setup screen, call up the Screen Save screen then perform the Screen Save steps. See the “Screen Save” section.

To return to the Screen Setup screen, select the [Return] key, then to return to the VD(VL) Check screen, select the [Return] key.

V-Size

This item adjusts the horizontal size of the image on the display screen. The currently set vertical image size value is displayed at the right of the [V-Size] key on the Screen Setup screen. On the Vertical Size screen, the currently set vertical size value is indicated by the number and indication bar. The factory initial setting value of the vertical size is 160* on the VD-900RA/RK.

* This is a typical value. This value depends on each VD-900RA/RK color display unit.

Procedure to Adjust the V-Size, Save the Changed Setting, or Exit the V-Size

To increase the height of the image on the screen, select and hold down the [Expand] key.

To decrease the height of the image on the screen, select and hold down the [Narrow] key.

To save the changed setting, return to the Screen Setup screen, call up the Screen Save screen, then perform the Screen Save steps. See the “Screen Save” section.

To return to the Screen Setup screen, select the [Return] key, then to return to the VD(VL) Check screen, select the [Return] key.

Pincushion

This item clears up the “pin cushion” distortion, in which the image bows inward or outward. The currently set pincushion value is displayed at the right of the [Pincushion] key on the Screen Setup screen. On the Pincushion screen, the currently set pincushion value is indicated by the number and indication bar. The factory initial setting value of the pincushion is 190* on the VD-900RA/RK.

* This is a typical value. This value depends on each VD-900RA/RK color display unit.

Procedure to Adjust the Pincushion, Save the Changed Setting, or Exit the Pincushion

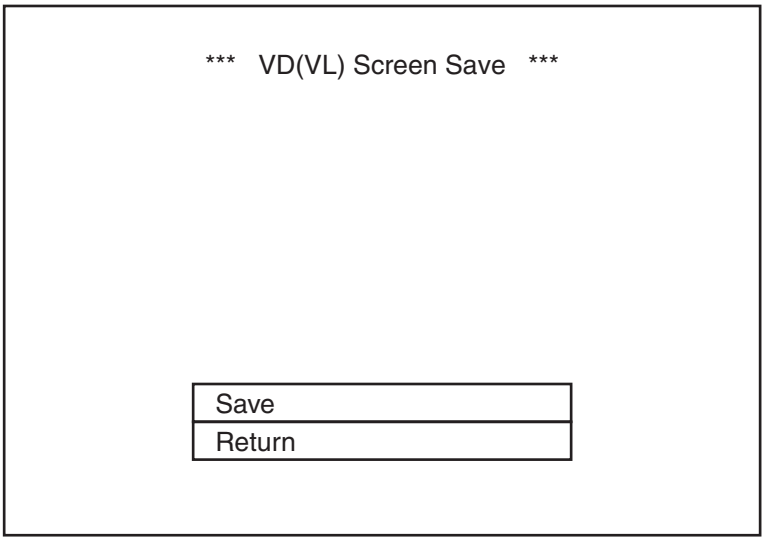
To increase the center of the image on the screen, select and hold down the [Expand] key.

To decrease the center of the image on the screen, select and hold down the [Narrow] key.

To save the changed setting, return to the Screen Setup screen, call up the Screen Save screen, then perform the Screen Save steps. See the “Screen Save” section.

To return to the Screen Setup screen, select the [Return] key, then to return to the VD(VL) Check screen, select the [Return] key.

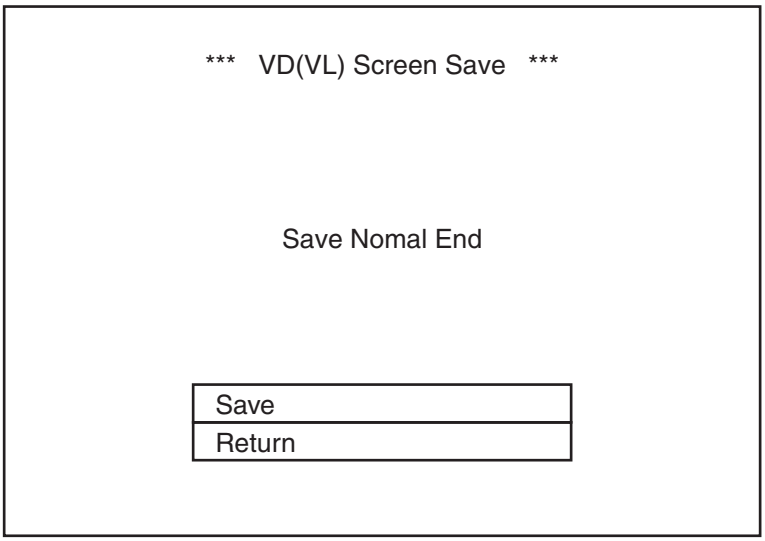
Screen Save



This item saves the current setting of the display screen to the EEPROM on the GUI board.

Procedure to Save the Display Screen Setting or Exit the Screen Save

To save the display screen setting, select the [Save] key. After the setting is saved correctly, the "Save Normal End" message appears.

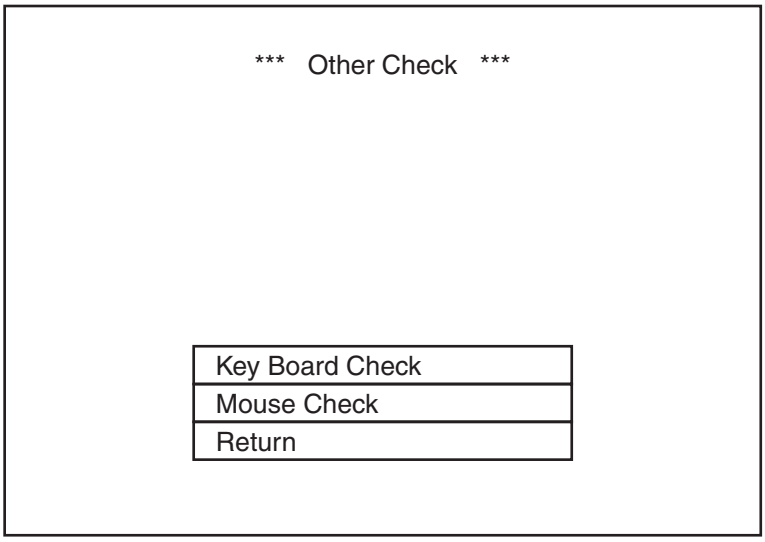


To return to the Screen Setup screen, select the [Return] key, then to return to the VD(VL) Check screen, select the [Return] key.

Other Check

The Other check menu items check the external instruments connected to the main unit.

The following Other check menu items are explained in the following pages.



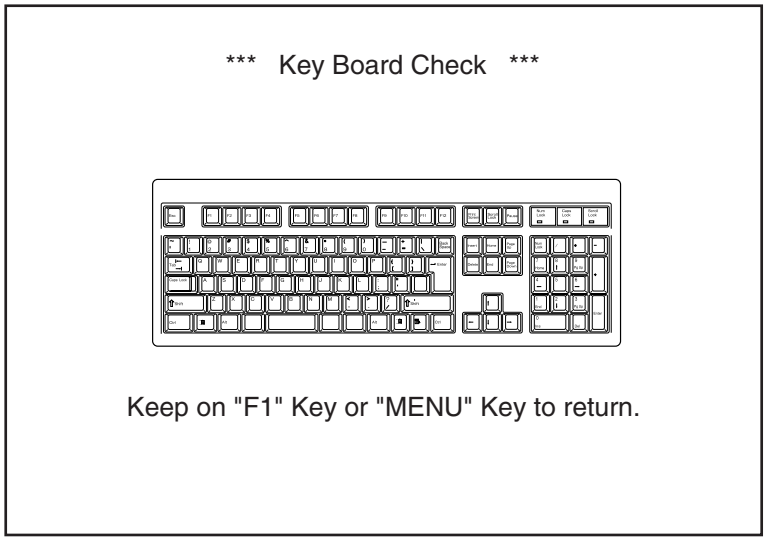
1. From the MU/VD Manual Check Menu screen, select the [Other Check] key. The Other Check screen appears.

2. From the Other Check screen, select the check item.

3. Select the [Start] key to start the selected check item. The selected check item screen appers. Some check items automatically run if the check item is selected.

4. To return to the MU/VD Manual Check Menu screen, select the [Return] key.

Keyboard Check



This item checks the key operation of the keyboard. A diagram of the keyboard is displayed on the screen. When any key of the keyboard is pressed, the corresponding pressed key on the screen is reverse shaded yellow.

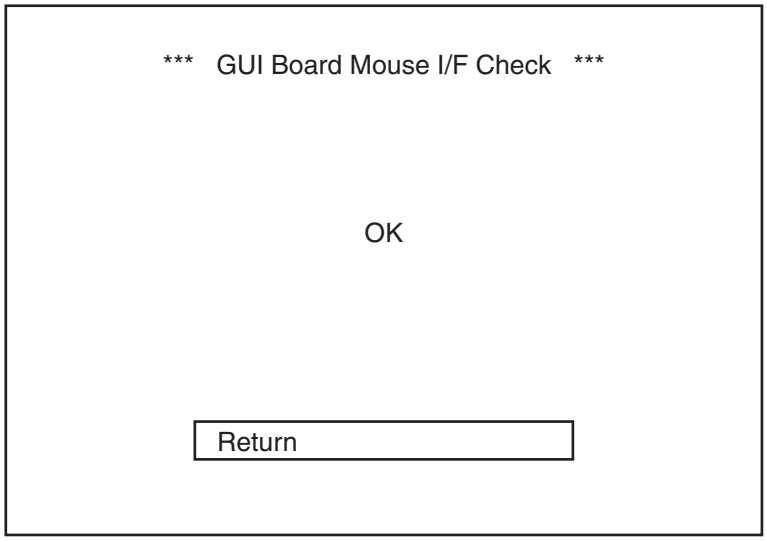
If the pressed key is not reverse shaded yellow, the key may be faulty. If more than one key is not reverse shaded yellow, the keyboard may be faulty.

Procedure to Check the keys or Exit the Keyboard Check

To check the key, press the key and confirm that the corresponding pressed key is reverse shaded yellow on the screen.

To return to the Other Check screen, press and hold the F1 or MENU key on the keyboard.

Mouse Check



This item checks the mouse operation. A blue mouse pointer is displayed on the screen. The mouse pointer follows the movement of the mouse. If the mouse pointer does not follow the movement of the mouse, the mouse may be faulty.

When the right mouse button is clicked, a red circle appears at the clicked portion of the screen. When the left mouse button is clicked, a yellow circle appears at the clicked portion. If the circle does not appear on the screen, the mouse may be faulty.

Procedure to Check the Mouse or Exit the Mouse Check

To check that the mouse pointer follows the movement of the mouse, move the mouse freely and confirm that the movement of the mouse pointer corresponds to the movement of the mouse.

To check the right mouse button, click the right mouse button and confirm that a red circle appears at the clicked portion.

To check the left mouse button, click the left mouse button and confirm that a yellow circle appears at the clicked portion.

To return to the Other Check screen, press and hold the F1 or MENU key on the keyboard.

Section 4 Board/Unit Description

Main Unit 4.1
PPC Board 4.1
Main GUI Board and GUI Board 4.2
VD/VL Display Unit 4.3
Input Box 4.4
Modules 4.4

Main Unit

The main unit has the following tasks.

- Data processing
- Data storage
- Data mixing for display
- Ethernet control
- Serial data communication between module/unit and main unit
- DC power supply to modules through the input box
- DC power supply to 10.4-inch color LCD unit
- AC power supply to 17-inch color display or 15-inch color LCD unit through the AC OUT socket

PPC Board

The PPC board which has one CPU, PowerPC603, and memories has the following functions in addition to the control of the other boards.

- Program memory: Consists of the boot ROM and flash memory card for system program.
- Data backup: Stores the various data in the ATA memory card through the PCMCIA interface.
- Network interface: Communicates with the instruments connected to the NETWORK socket through the network according to the Ethernet and TCP/IP.
- Serial interface: Communicates with a unit (future function) or personal computer connected to the SERIAL socket according to the RS-232C protocol.
- Real time clock: Used for date and time.
- Temperature sensor: A thermistor is mounted on this board. The output signal from the sensor goes to the Main GUI board which has a 4-channel multiplexer for collection of the temperature data on each board in the main unit.

Main GUI Board and GUI Board

These boards commonly have the following functions.

- Two analog RGB signal outputs for the VD/VL display unit and a locally available display unit: The graphic data which is processed through the SVGA accelerator is mixed with waveform data to output the analog RGB signals at the VD/VL and RGB sockets on the boards.
- Display unit interface: Communicates with the display unit using the specific serial interface protocol. These boards receive the key status data of the control panel or remote control from the VD/VL display unit and send the display control data such as brightness, contrast, and size to the VD/VL display unit. The alarm indicator on the VD/VL display unit is controlled by the PPC board through this serial communication.
- Touch screen interface: Receives the status data of the touch screen from the VD/VL display unit using RS232C serial interface protocol.
- Audio circuit: Consists of the preamplifier and FM sound source IC with sound volume control.
- Temperature interface: Consists of thermistor probe and A/D converter to monitor overheating in the main unit. The A/D converter has 4 input channels which get the temperature data from up to 4 different boards such as the PPC board and GUI board.

Only the Main GUI board has the following functions.

- Keyboard and mouse interfaces: Receives each key status data of the keyboard and mouse connected to the KEYB and MOUSE sockets on the board according to the PS/2 type protocol.
- Alarm pole driver: Outputs the DC power and control data to the alarm pole to blink or light it.
- JA input box interface: Communicates with the input box, modules, and units using Nihon Kohden original serial interface protocol.
- Power control interface: Controls the power on and standby mode. The PowerPC603 on the PPC board changes the monitor condition to the standby mode when the front power switch on the VD/VL display unit or the power button on the remote control is pressed during the power on. The PowerPC603 turns on the monitor from the standby mode by counting the pulses from the VD/VL display unit. The power control interface only works with the PowerPC603 when the AC power switch on the rear panel of the main unit is set to on. The EEPROM memorizes the last condition settings before the AC power switch is set to off or the power is lost.

VD/VL Display Unit

The VD/VL display unit has the speaker, main amplifier, touch screen, and analog RGB input. The status data of the touch screen, control panel, and remote control is sent to the main unit. The VD/VL display unit turns on when the analog RGB signals from the main unit are synchronized with the receptor of the VD/VL display unit. The VD/VL display unit accepts the front power switch on the front panel and power button on the remote control even in the standby mode. The channel setting of the remote control is saved in the VD/VL display unit.

Input Box

The input box relays the signals between the main unit and modules. The step down switching regulator in the input box generates +10 V from +24 V supplied from the main unit to supply the +10 V to each module.

Modules

Each module has signal input port(s) and primary data processing block. The CPU in each module controls the A/D conversion of the input signal(s) and the primary data processing and the processed data is sent to the main unit according to the Nihon Kohden serial data transfer protocol. After isolating the power supplied from input box, each module generates the necessary voltages from the isolated power.

Section 5 Disassembly and Assembly

Before You Begin 5.1
- Warnings and Cautions 5.1
- Required Tools 5.1

Main Unit 5.2
- Removing the Blank Panel 5.2
- Removing the Connector Holder Panel 5.3
- Removing the GUI Board 5.4
- Removing the PPC Board 5.5
- Putting Back the Blank Panel 5.6
- Putting Back the PPC and GUI Boards 5.6
- Putting Back the Connector Holder Panel 5.7

Replacing the Memory Card and Boot ROM 5.8
- Removing the Blank Panel, GUI Board and PPC Board 5.8
- Replacing the Memory Card 5.8
- Replacing the Boot ROM 5.10
- Reattaching the Blank Panel, and GUI and PPC Boards 5.12

Replacing the Power Unit 5.13

Color Display Unit 5.17
- Removing the Control Panel 5.17
- Attaching the Blank Panel 5.18
- Replacing the Control Panel 5.19

The procedures in this section tell how to remove, replace and install major components in the instrument.

Before You Begin

Removing, replacing and installing major components should be done by qualified service personnel.

Warnings and Cautions

WARNINGS

- **To avoid the possibility of injury to yourself or damage to the instrument, do not install or remove any component or change switch settings while the power is on. Wait 10 minutes after the power is off before installing to or removing any component from the instrument.**
- **To avoid accidental discharge of static electricity which could damage the instrument components, use a wrist ground strap when installing or removing any component of the instrument.**

CAUTIONS

- **Before connecting or disconnecting any cables, turn off the instrument, unplug the AC power cord from the instrument and remove the rechargeable battery.**
- **Fuses cut off the power when an abnormality occurs in the instrument. Eliminate the malfunction before replacing the fuse. Use the correct fuse only. The fuse rating is shown on the holder.**
- **Removal and replacement of any component in the instrument should be done by qualified service personnel.**
- **Use only parts recommended by Nihon Kohden to assure maximum performance from your instrument.**

Required Tools

- Anti-static bench mat
- Wrist ground strap
- M3 Phillips screwdriver (insulated type)
- M4 Phillips screwdriver (insulated type)
- Flat-blade screwdriver (insulated type)

Main Unit

CAUTION

- **To avoid the possibility of injury to yourself or damage to the instrument, turn the power off and remove the power cord from the instrument before installing or removing any component from the instrument.**
- **Protect yourself from electrical shock by using a wrist ground strap or wearing the rubber gloves.**

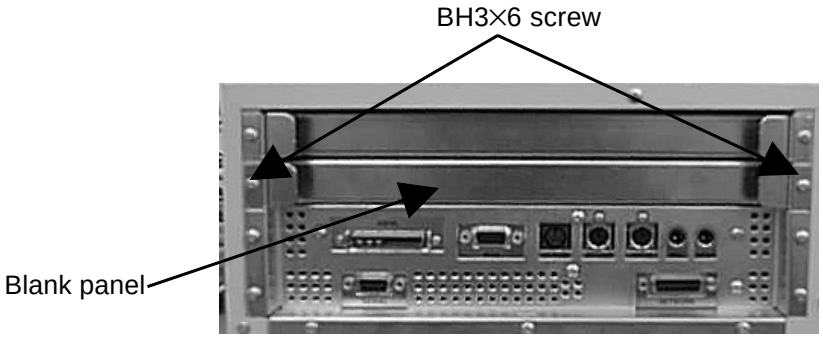
When removing the blank panel, GUI board and PPC board from the main unit, they must be removed in the following order.

1. blank panel
2. GUI board
3. PPC board

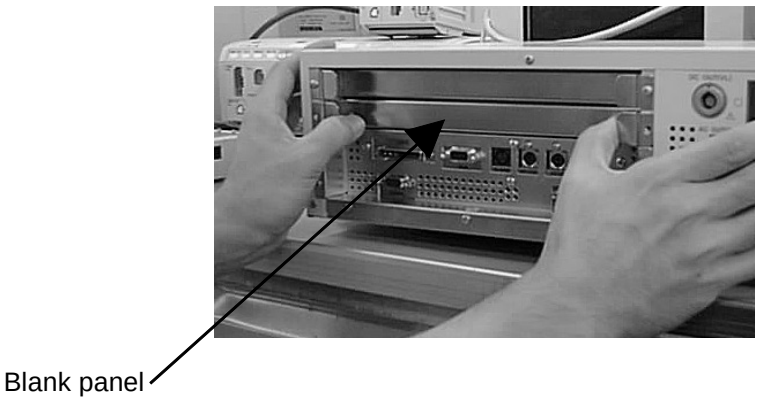
Removing the Blank Panel

1. Turn off the instrument, unplug the AC power cord and remove all the cables connected to the rear of the main unit.

2. Remove the two BH3×6 screws.

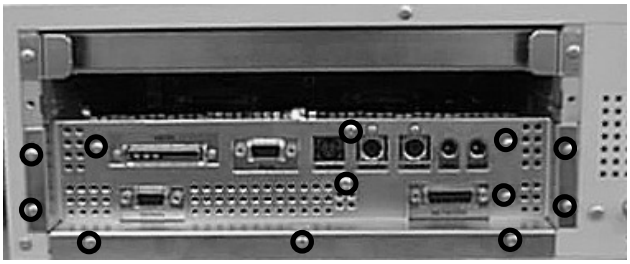


3. Pull out the blank panel by the protrusions at both ends of the blank panel, as shown below.

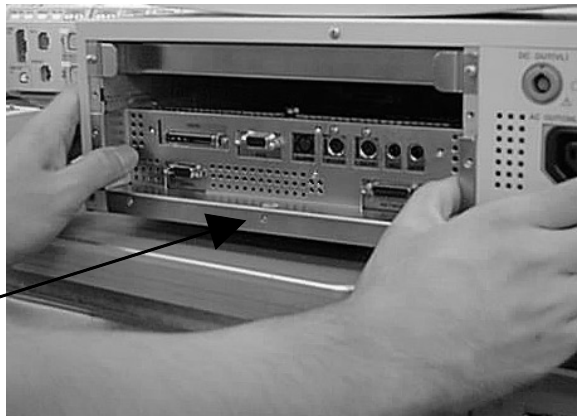


Removing the Connector Holder Panel

1. Remove the 12 BH3×6 screws indicated by circles.



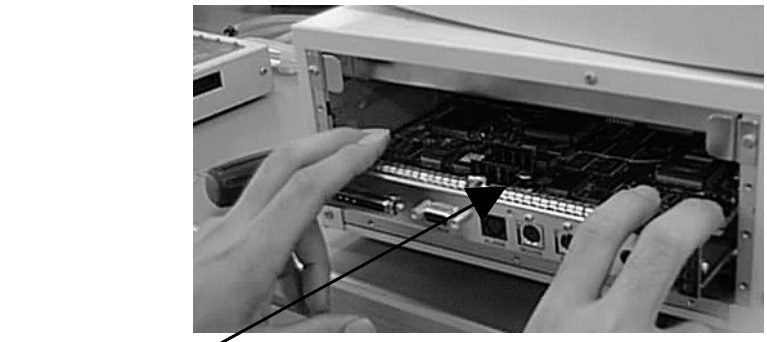
2. Pull out the connector holder panel by the ends, as shown below.



The following picture shows the unit after the connector panel holder has been removed.

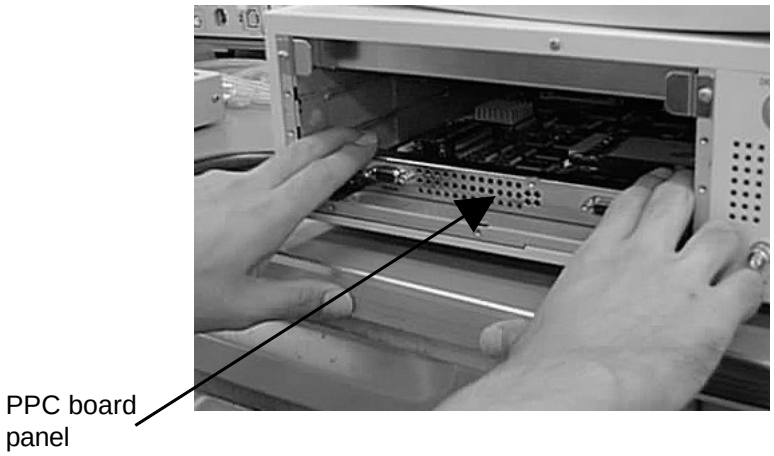
Removing the GUI Board

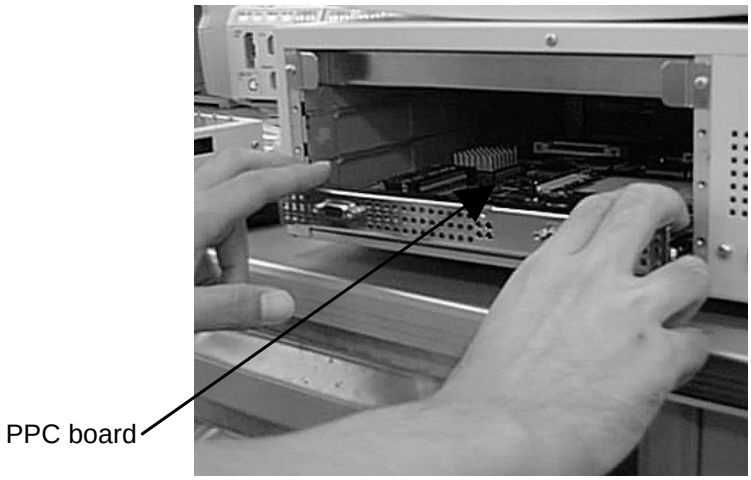
Put your fingers on the upper edges of the GUI board panel (see the upper figure) and carefully pull out the GUI board (see the lower figure).



Removing the PPC Board

Put your fingers on the upper edges of the PPC board panel (see the upper figure) and carefully pull out the PPC board (see the lower figure).



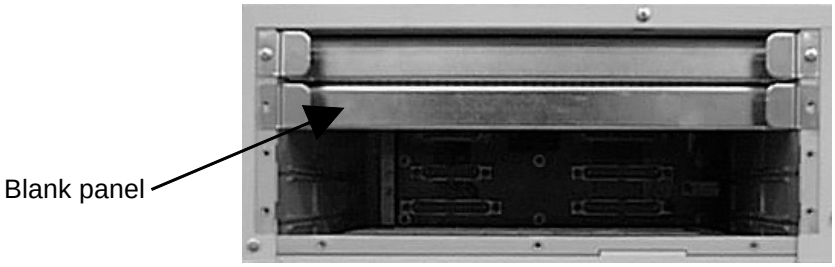


When replacing the blank panel, GUI board and PPC board in the main unit, they must be replaced in the following order.

1. blank panel
2. PPC board
3. GUI board

Putting Back the Blank Panel

Reattach the blank panel to the correct slot in the main unit. Do not fasten the two BH3×6 screws yet. Otherwise, it might be harder to correctly reattach the GUI and PPC boards later.

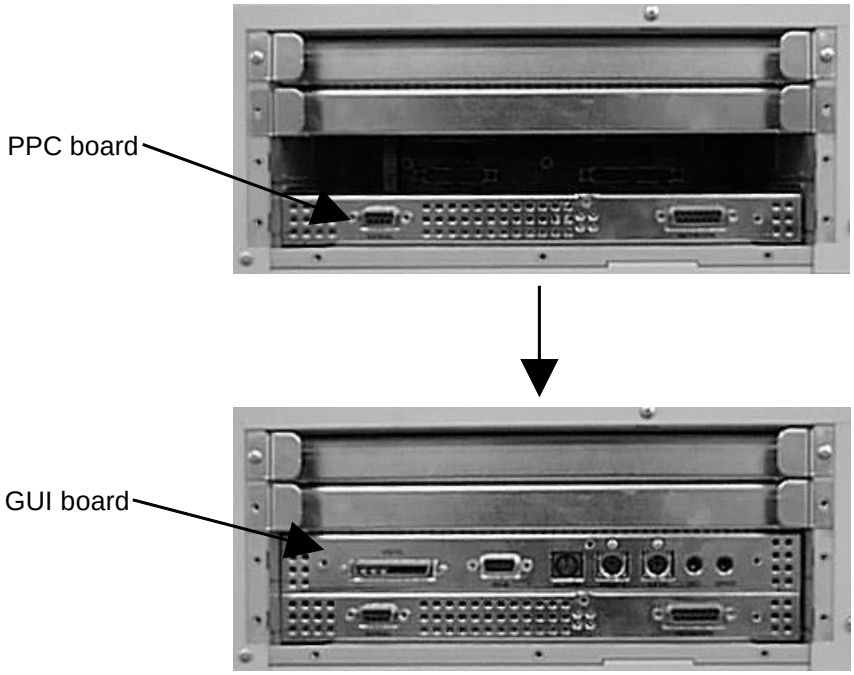


Putting Back the PPC and GUI Boards

CAUTION

If the PPC and GUI boards are not reattached in the following order, the bronze ground springs on the edge of each board panel may come off. If the ground spring comes off and falls on a board, the board will malfunction due to short-circuit.

Reattach the PPC and GUI boards to the correct slots in this order.



Putting Back the Connector Holder Panel

Reattach the connector holder panel and fasten the 14 BH3×6 screws indicated by circles to attach the blank panel, connector holder panel, GUI board and PC board.

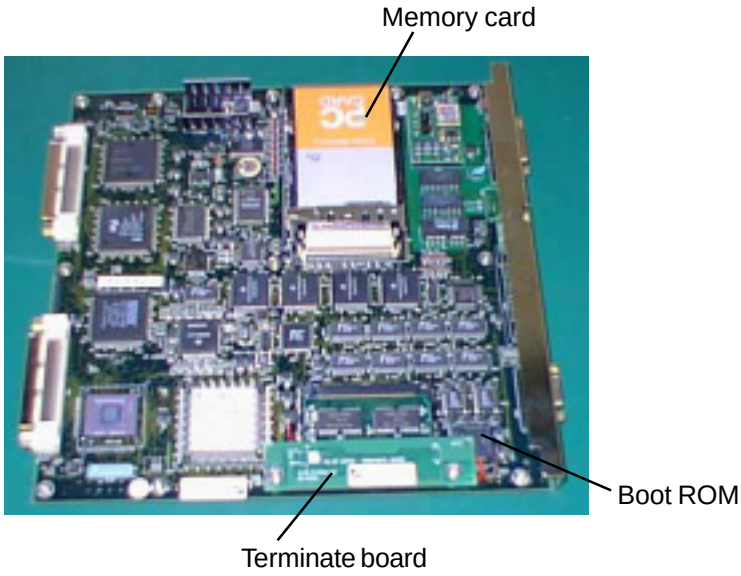
Replacing the Memory Card and Boot ROM

Removing the Blank Panel, GUI Board and PPC Board

The memory card and boot ROM are mounted on the PPC board. To replace the memory card and boot ROM, the blank panel, GUI board and PPC board must be removed before replacement.

1. Remove the blank panel, GUI board and PPC board in this order as described in the “Disassembly and Assembly” section.

   The following shows the location of the memory card and boot ROM on the PPC board.

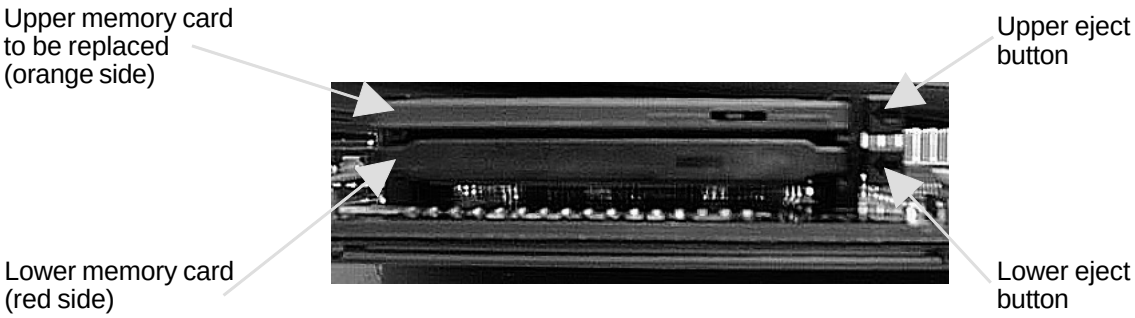


Replacing the Memory Card

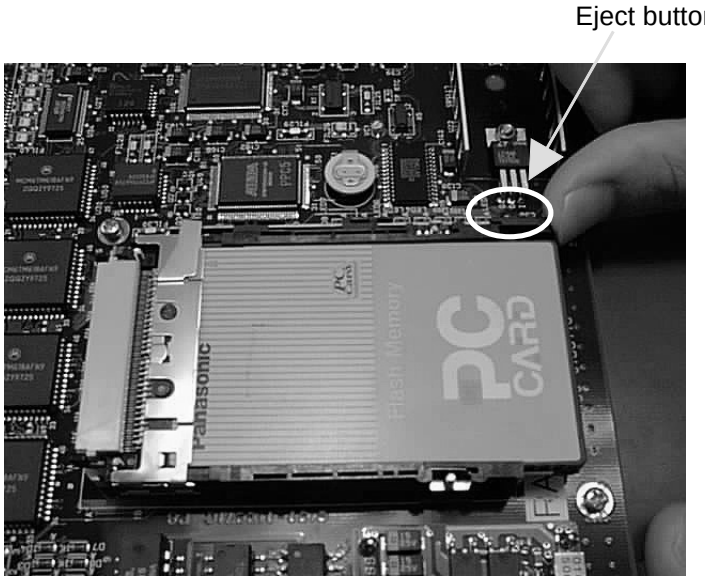
There are two memory cards installed on the PPC board:

- The upper memory card (orange side) saves the system software
- The lower memory card (red side) saves the acquired data

To upgrade the system software, the upper memory card (orange side) must be replaced with a newer version.

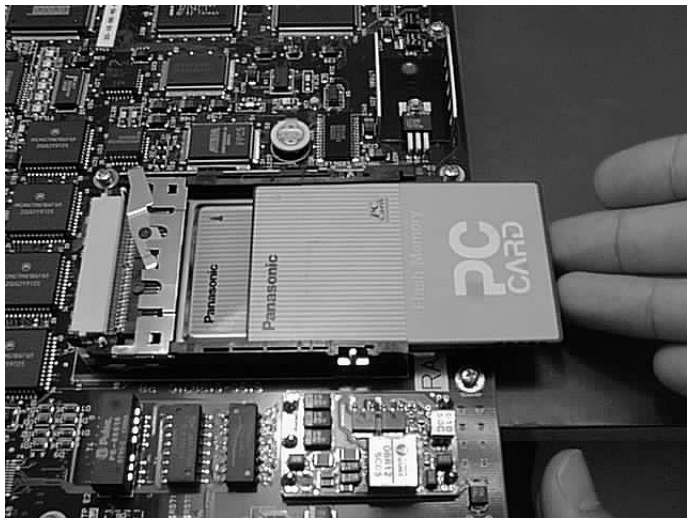


1. Press the upper eject button of the memory card to eject the system software memory card. The memory card is ejected out of its slot about 1 inch.



2. Remove the memory card.

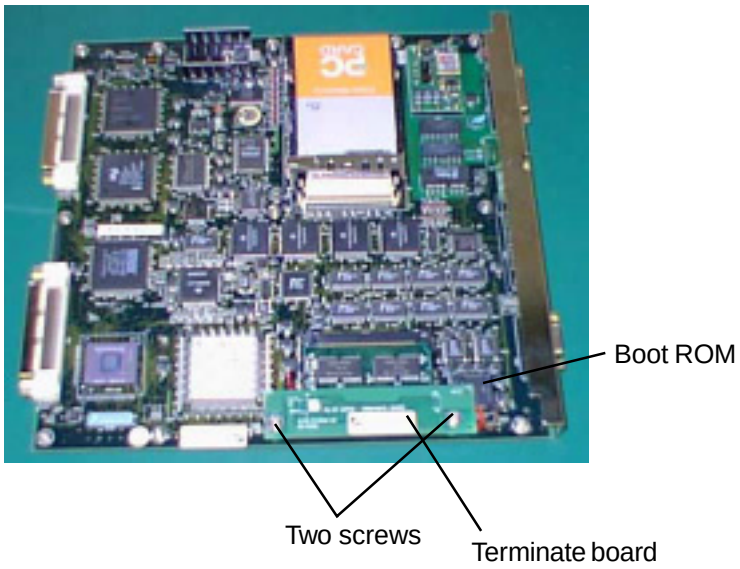
3. Insert the new system software memory card into the upper memory card slot according to the arrow indicating the direction for its insertion.



4. Make sure that the upper eject button clicks to the out position.

Replacing the Boot ROM

1. Remove the two screws which hold the Terminate board.

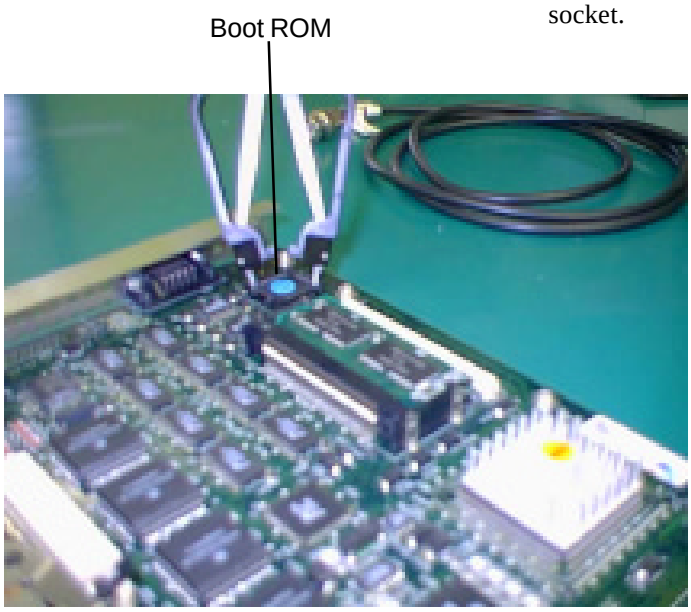


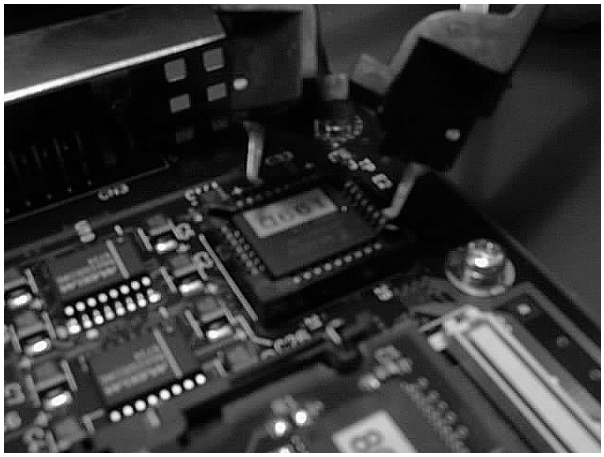
2. Use a PLCC extractor (model GX-8) or flat-blade screwdriver to remove the boot ROM from its socket.

   When using a PLCC extractor:

   a) Properly expand the width of the legs of the extractor, matching the size of the boot ROM.

   b) Put the paws of the legs of the extractor into the grooves of the boot ROM socket.





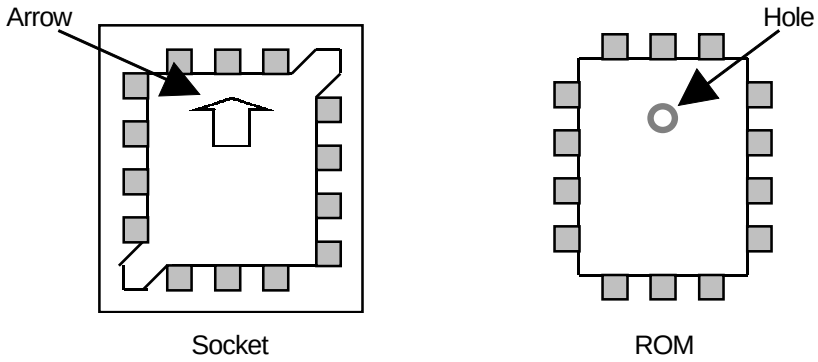
   c) Correctly hook the boot ROM with the paws of the extractor and grasp the legs of the extractor.

   d) Gently pry off the boot ROM while holding the boot ROM socket.

When using a flat-blade screwdriver:

a) Put the tip of the flat-blade screwdriver into each groove of the boot ROM socket and gradually lift off the boot ROM from its socket little by little.

3. Carefully place the new boot ROM in its socket so that all the pins go into the socket and that the ROM direction is correct. When the position of the hole on the boot ROM matches the arrow on the ROM socket, the ROM direction is correct.



Reattaching the Blank Panel, and GUI and PPC Boards

1. Reattach the blank panel, GUI board and PPC board in this order to their slots on the main unit as described in the “Disassembly and Assembly section. Do not fasten the screws to attach them yet.

2. Initialize the system on the System Setup screen and verify the revision of the installed software with the following steps.

   a) Call up the Diagnostic Check and System Setup screen: Turn on the power of the bedside station main unit while pressing the SILENCE ALARMS key on the control panel of the display unit or the remote control until the Diagnostic Check and System Setup screen appears.

   b) Select [System init] to initialize the bedside station system and erase all stored data. The System Init window appears.

   c) Select SILENCE ALARMS key. [All Clear] becomes selectable.

   d) Select [All Clear]. The “Wait a minute” message appears on the screen. Initializing the system is successfully completed when the message disappears.

   e) Select [Exit] to return to the Diagnostic Check and System Setup screen. Select [Monitor Mode] to reset the bedside station system. Messages similar to the following appear on the screen.

```
Boot ROM version 01-03 1997/12/16
Mac Address = 00:A0:9A:FF:FF:26
Memory Checking .....OK
Memory-card:  Found
Boot Media = Memory-Card
Loading
.........#
System Start
Version = 01-08
```

   f) Make sure that the “Version” displayed matches the software version number installed. If the version number is correct and the normal monitoring screen appears after the “Wait a minute” message appears, the installation is successful. If the installation is not successful, check that the new memory card or boot ROM is correctly inserted into its slot or socket and try the above procedures again.

   g) Turn off the power of the main unit.

3. Reattach the connector holder panel to the GUI and PPC board panels and fix the blank panel, GUI board, PPC board and connector holder panel with the 14 BH3×6 screws.

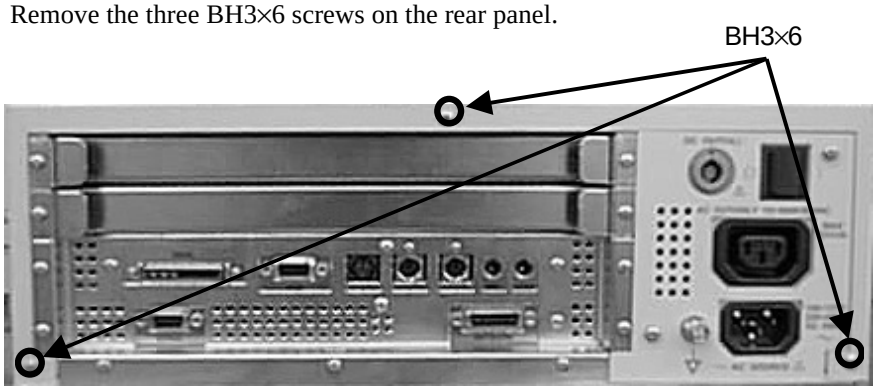
Replacing the Power Unit

1. Removing the front cover.
   Remove the two BH3×6 screws on the bottom of the front cover.

   Pull the bottom of the front cover toward you, then unhook the top of the front panel from the casing. Pull down the front cover to remove it.

2. Removing the filter case
   Remove the filter case on the left side by sliding the case to the right as shown below.

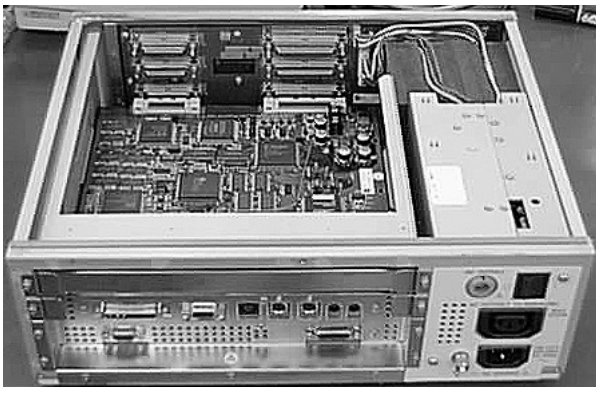
3. Removing the top cover
   Remove the three BH3×6 screws on the rear panel.



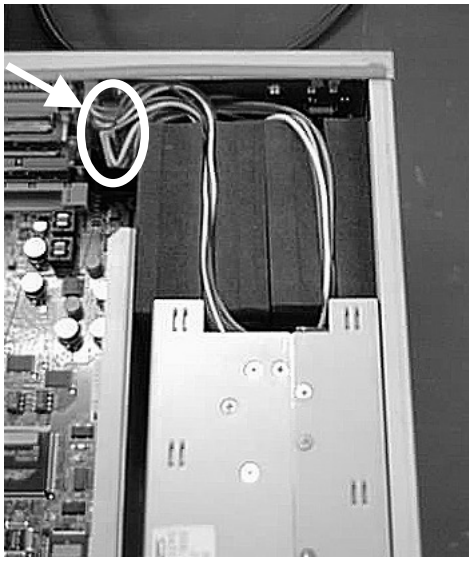
From the rear of the main unit, pull the top cover toward you (Figure A). Pull up the top cover by spreading both sides (Figure B).

Figure A

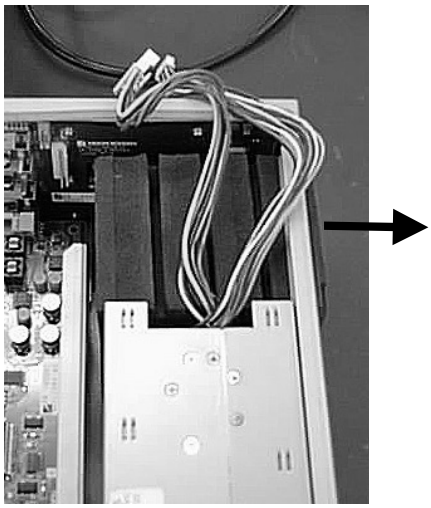
Figure B

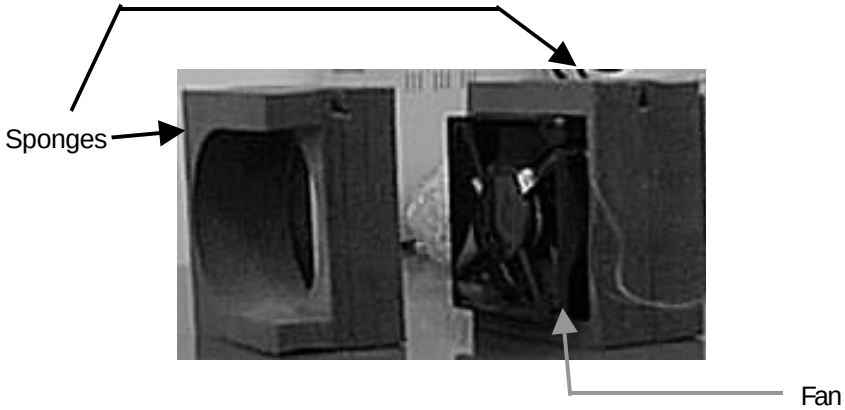


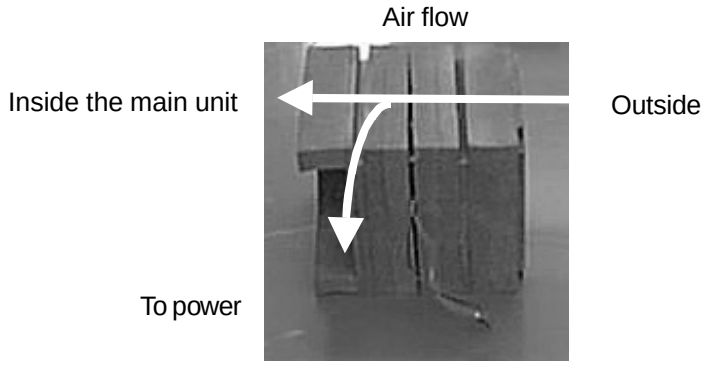
4. Disconnecting the power cables and fan
   Disconnect the power cables connected to the motherboard.



Remove the fan and the two sponges surrounding the fan from the left side, then remove the power cable of the fan from the power unit.

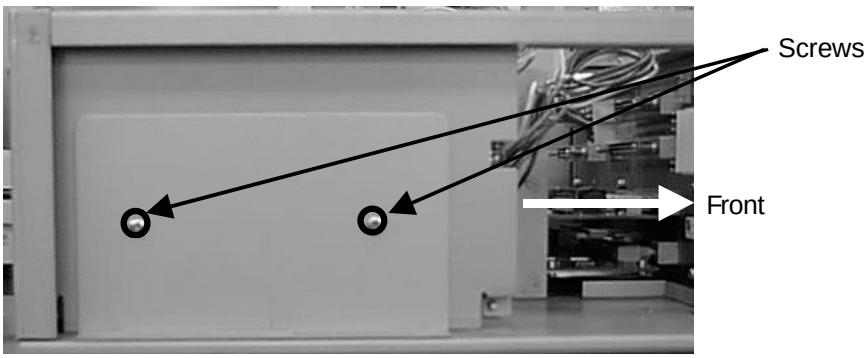






5. Removing the rear panel
   Remove the two BHX4 screws, then remove the rear panel.

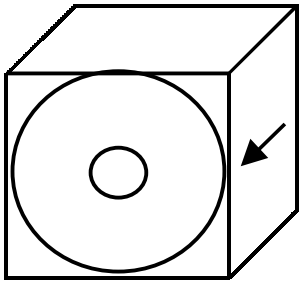
6. Removing the power unit
   Remove the two PSW3×8 screws, then slide the power unit to the front.



7. Reassembling the main unit
   Reassemble the main unit by reversing steps 6 to 1.

NOTE

There is an arrow indicating the air flow on the fan. Take care to attach the fan so that air flows outside to inside and the fan power cable goes through the slot inside the sponge.



Color Display Unit

The color display unit can be disassembled to do either of the following:

- Replace the control panel with a new one.
- Attach the blank panel to where the control panel was. This is for users who do not use the control panel to operate the instrument.

This sub-section describes:

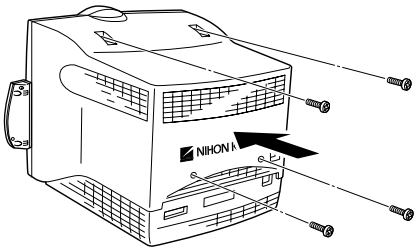
- How to remove the control panel
- How to attach the blank panel
- How to reattach the control panel

Removing the Control Panel

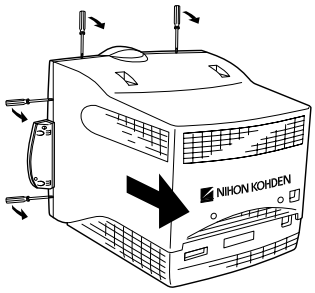
1. Turn off the power of the main unit and the color display unit.

2. Remove the power cord and the display cable from the rear panel of the color display unit.

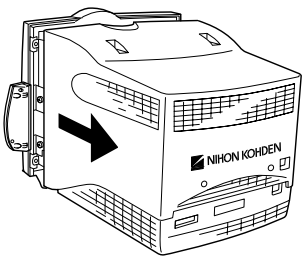
3. Remove the four screws from the rear panel of the color display unit. Do not lose the screws.

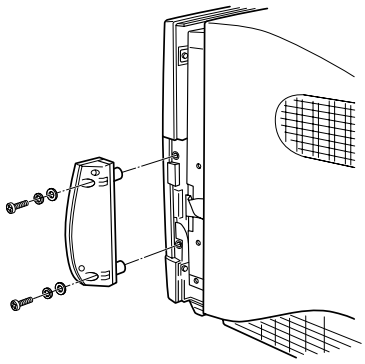


4. Starting from the top and working down toward the sides, insert the flat blade screwdriver between the front and rear panels and twist it once to separate the rear and front panels. Do this at about 8 places.



5. Slide the rear panel back until you can see the two screws for the blank panel on the right side panel.





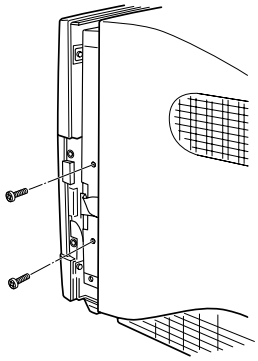
6. Remove the two screws which fix the control panel to the color display unit and remove the control panel from the color display unit.

NOTE

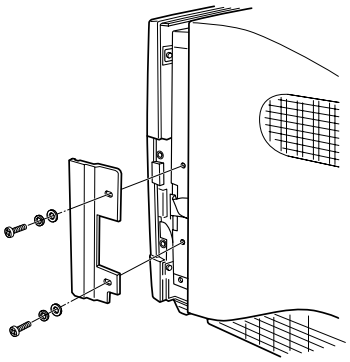
Keep the removed screws for the next use.

Attaching the Blank Panel

If you are replacing the control panel with a new one, go to the next section "Replacing the Control Panel".

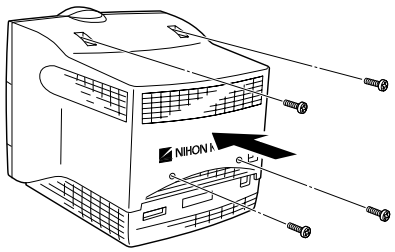


1. Remove the two screws which fix the blank panel to the color display unit.



2. Attach the blank panel to the place where the control panel was attached and fasten it with the two screws which were removed from the color display unit in step 1.

3. Reattach the rear panel by hooking the tab of the rear panel to the front panel of the color display unit.

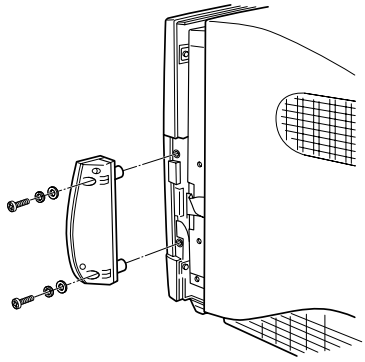


4. Fasten the front panel and the rear panel with the four screws which were removed in step 3 in the previous "Removing the Control Panel" section.

5. Connect the power cord and the display cable to the sockets on the rear panel of the color display unit.

6. Turn on the power of the main unit and the color display unit.

Replacing the Control Panel



1. Attach the control panel to the color display unit with the two screws.

2. Reattach the rear panel to the color display unit by doing steps 3 to 4 in the “Attaching the Blank Panel” section.

3. Connect the power cord and the display cable to the sockets on the rear panel of the color display unit.

4. Turn on the power of the main unit and the color display unit.

Section 6 Maintenance

Measuring and Test Equipment 6.1
- Measuring Equipment 6.1
- Test Equipment 6.1

Maintenance Check Items and Schedule 6.2
- External 6.2
- Input Box 6.2
- Operation 6.3
- Display Unit 6.3
- Recorder Module 6.3
- Vital Sign Parameter 6.4
- Safety 6.5
- Data Backup 6.6
- Others 6.6

Maintenance Check Sheet 6.7

Measuring and Test Equipment

Measuring Equipment

Specified measuring equipment is not required.

Test Equipment

To repair, check, or adjust the instrument, the following test equipment or equipment with similar function and performance is required.

- AX-800P Vital Sign Simulator: The simulator outputs simulated waveforms, i.e. ECG waveform, respiration curve, 4 blood pressure waveforms, 2 temperature fixed values, and cardiac output curve.
- 548631A Adapter Cable: Although the simulator has the connection cable for previous bedside monitors such as BSM-2100/3101/7000/8300/8502/8800, the new bedside monitors such as BSM-1100/9510 and BSS-9800 require this adapter cable instead of the previous bedside monitor connection cable.

Maintenance Check Items and Schedule

External

Item	Check Procedure	Action
Dirt	Check that the outside of the instrument is not dirty.	If the outside of the instrument is dirty, clean it with a cloth moistened with water, neutral soap or alcohol.
Damaged switch or key top cover	Check that there are no physically damaged switches and key top covers.	If any switch or key top cover is damaged, replace it with a new one.

Input Box

Item	Check Procedure	Action
Contact between module and input box	Check that there is no obstruction between the module and input box.	Remove the cause if the contact between the module and input box is poor.
Module connector and input box connectors	Visually check that there is no damaged module connector and input box connector.	If a module connector is damaged, replace the module with a new one. If a connector on the input box is damaged, replace the connector with a new one.
Contact between input socket on module and connector of input connection cord	Check that there is good contact between the module input socket and connector of the input connection cord.	Remove the cause if there is a poor contact between them.
Input socket on module or connector of input connection cord	Visually check that there is no damaged input socket and connector.	If the input socket or connector is damaged, replace it with a new one.
Electrode lead wire or input connection cord	Visually check that there is no damage of the lead wire and connection cord.	If the electrode lead wire or input connection cord has a damage, replace it with a new one.

Operation

Item	Check Procedure	Action
Key function on the control panel	Check that the function of each key on the control panel works correctly.	Remove the cause if the key function is wrong.
Touch screen key function	Check that the function of each key on the screen works correctly.	Remove the cause if the key function is wrong.
Key function on the remote control	Check that the function of each key on the remote control works correctly.	Remove the cause if the key function is wrong.
Battery cover of the remote control	Check that the battery cover is placed on the back of the remote control.	If the battery cover is lost, place an order for it.
Key function on the keyboard	Check the function of each key on the keyboard.	Remove the cause if the key function is wrong.
Mouse function	Check that the mouse works correctly.	If the mouse has a malfunction, remove the cause.

Display Unit

Item	Check Procedure	Action
Crack, scratch or dirt	Check that there is no crack, scratch or dirt on the display unit.	If there is a crack or scratch on the screen, replace it with a new one. If the screen is dirty, clean it with a soft cloth moistened with water.
Display control settings	Check that the control settings such as brightness and contrast work correctly.	If one of the control settings has no function, remove the cause.

Recorder Module

Item	Check Procedure	Action
Waveform and character data on paper	Check that the waveform and character data on the paper are clear.	If the waveform or character data is not clear, replace the recorder module with a new one.
Date and time	Check that the date and time are printed on the paper.	If there is no date and time on the paper, replace the PPC board with a new one.
Recording paper	Check that the recording paper is produced by Nihon Kohden.	If unspecified paper is used, replace it with Nihon Kohden specified paper.

Vital Sign Parameter

Item	Check Procedure	Action
Parameter error	Check that no parameter error is displayed on the screen when plugging a module into the input box.	If the parameter error appears on the screen, plug the module into another slot of the input box to find the cause.
Parameter window	Check that the parameter window opens on the screen when the corresponding module key on the module except for the MULTI sockets of AY-900PA/910PA and AA-900PA is pressed. To check the parameter window related to the MULTI sockets, connect the input connection cord and press the module key.	If the parameter window does not open on the screen, remove the cause.
Waveform and numeric data	Check that ECG, respiration, blood pressure waveforms, their parameters and temperature data are displayed correctly and QRS synchronous sound is generated when connecting AX-800P vital sign simulator to the modules.	If there is anything wrong, check each part between the AX-800P and module.
SpO_2 and NIBP	Check that the displays of SpO_2 and NIBP parameters are acceptable when applying the SpO_2 probe and NIBP cuff to a healthy person or yourself.	If there is a big difference, check each part between the healthy person and module.
MULTI socket function	Check that the input connection cord is recognized and the related parameter is displayed when changing the input connection cord.	If the MULTI socket has no function, plug the module into another slot of the input box to find which has a malfunction, the module or input box.
Zero balance of IBP	Check that the blood pressure transducer is zero balanced when setting the blood pressure of the simulator to zero and pressing the MULTI key on the module.	If the transducer is still imbalanced after zeroing, plug the transducer into another MULTI socket of the module or a module with the MULTI socket.
Label setting	Check that the site labels for blood pressures and temperatures can be selected from the site label list.	If the site label cannot be changed, replace the input connection cord or module with a new one.
Alarm function	Check that the alarm mark appears on the screen, the alarm indicator works, and the alarm sounds when an alarm occurs.	If there is anything wrong, check the corresponding part.
Transducer	Check that the specified sensor and transducer are used.	If the unspecified sensor or transducer is used, replace it with the specified one.

Safety

Item	Check Procedure	Action
Power cord	Check that the power cord does not have any damage, poor continuity, heat, sound or smell while bending each part of the power cord.	If the power cord has malfunction, replace it with a new one.
Ground lead	Check that the ground lead has no damage and no poor continuity while bending each part of the ground lead.	If the ground lead has a malfunction, replace it with a new one.
Fuse	Check that the specified fuses are used and not blown.	If a fuse is blown, replace it with a new one.

Perform the following patient safety check after repairing the instrument.

Item		Check Procedure	Action
Protective earth impedance (refer to IEC 60601-1 18.(f))		Check that the impedance between the protective earth contact and any accessible metal part does not exceed 0.1 Ω.	Remove the cause if the impedance exceeds 0.1 Ω.
Earth leakage current (refer to IEC 60601-1 19)		Check that the earth leakage current does not exceed 0.5 mArms under normal condition and 1.0 mArms under each single fault condition.	Remove the cause if the earth leakage current exceeds one of the maximum values.
Enclosure leakage current (refer to IEC 60601-1 19)		Check that the enclosure leakage current does not exceed 0.1 mArms under normal condition and 0.5 mArms under each single fault condition.	Remove the cause if the enclosure leakage current exceeds one of the maximum values.
Patient leakage current (refer to IEC 60601-1 19)	Patient leakage current	Check that the patient leakage current to type CF or defibrillation-proof type CF applied part does not exceed 0.01 mArms under normal condition and 0.05 mArms under each single fault condition.	Remove the cause if the patient leakage current exceeds one of the maximum values.
		Check that the patient leakage current to type BF or defibrillation-proof type BF applied part does not exceed 0.1 mArms under normal condition and 0.5 mArms under each single fault condition.	
	Patient leakage current (mains voltage on the applied part)	Check that the patient leakage current to type CF or defibrillation-proof type CF applied part does not exceed 0.05 mArms under each single fault condition.	
		Check that the patient leakage current to type BF or defibrillation-proof type BF applied part does not exceed 5 mAmrs under each single fault condition.	
Withstanding voltage (refer to IEC 60601-1 20)		Check that the instrument has the following withstanding voltages. ● A-a1: 1500V AC for one minute ● A-f: 1500 V AC for one minute ● B-a: 4000 V AC for one minute* ● B-d: 1500 V AC for one minute* *Perform the check with the module inserted.	Remove the cause if the instrument does not have all the withstanding voltages.

Data Backup

Item	Check Procedure	Action
System Setup data backup	Check that the System Setup data is saved for a long time after the power off.	If the System Setup data disappears within 30 minutes after the power off, replace the super capacitor on the PPC board with a new one.
Alarm setting data backup	Check that the alarm setting data is saved for a long time after the power off.	If the alarm setting data disappears within 30 minutes after the power off, replace the super capacitor on the PPC board with a new one.
Clock function	Check that the clock function works correctly when the power is off.	If the clock stops while the instrument is turned off, replace the lithium battery on the PPC board with a new one.

Others

Item	Check Procedure	Action
Line voltage	Check that the line voltage is within the range of nominal voltage ±10%.	Use only the line voltage within the correct range.
Connection to other equipment	Check that the instrument is correctly connected to other equipment according to the operator's manual.	If there is a wrong connection, connect the equipment to the instrument correctly according to the operator's manual.
Vibration or resonant sound	Check that the instrument has no abnormal vibration or resonant sound.	Remove the cause of abnormal vibration or resonant sound.
Screws	Check that there are no loose screws.	If any screw is loose, tighten it.

Maintenance Check Sheet

(Refer to the Maintenance section for details.)

Customer: _____ Customer Address: _____

Service Personnel: _____ Service Company: _____

Instrument Name: _____ Instrument Model: _____

Instrument Serial Number: _____ Hardware Revision: _____

Software Revision: _____

External

There is no dirt, stain, and crack on the instrument.	Yes	No
There are no damaged switches and key top covers.	Yes	No
The warning and caution labels are clearly readable.	Yes	No

Input Box

There is good contact between the module and input box connectors.	Yes	No
There is no damage on the module connector and input box connectors.	Yes	No
There is good contact between the input socket on the module and connector of the input connection cord.	Yes	No
There is no damage on the input socket and input connection cord connector.	Yes	No
There is no damage and internal cut on the lead wire and connection cord.	Yes	No

Operation keys

The function of each key on the control panel works correctly.	Yes	No
The function of each key on the screen works correctly.	Yes	No
The function of each key on the remote control works correctly.	Yes	No
The battery cover is placed on the back of the remote control.	Yes	No
The function of each key on the keyboard works correctly.	Yes	No
The mouse works correctly.	Yes	No

Display

The brightness is correctly adjusted.	Yes	No
There is no distortion on the screen.	Yes	No
The half brightness display on the CRT correctly works.	Yes	No

Vital Sign Parameters

No parameter error is displayed on the screen when the module is plugged into the input box.	Yes	No
Pressing a module key opens the parameter window on the screen.	Yes	No
ECG waveform, heart rate, and QRS synchronous mark are properly displayed with QRS synchronous sound generated.	Yes	No
Respiration waveform and respiration rate are properly displayed.	Yes	No
Plethysmographic pulse waveform and SpO_2 data are properly displayed.	Yes	No
NIBP data (systolic, diastolic, and mean blood pressures) are acceptable.	Yes	No
MULTI sockets recognizes the respective input connection cords and the waveforms and data are properly displayed.	Yes	No
MULTI key on the module allows zero balance of the blood pressure transducer.	Yes	No
Site labels for blood pressures and temperatures can be selected from the site label list.	Yes	No
Alarm functions properly.	Yes	No
Alarm indicator works properly.	Yes	No
Alarm sound works properly.	Yes	No
Specified sensor and transducer are used.	Yes	No

Recorder

Waveforms are clearly recorded on the paper.	Yes	No
Alphanumeric data is clearly recorded on the paper.	Yes	No
Date and time is recorded on the paper.	Yes	No
Specified recording paper is used.	Yes	No

Backup

System setup data is saved.	Yes	No
Alarm setting data is saved.	Yes	No
Clock function works properly when the instrument is turned off.	Yes	No

Safety

Power cord (and ground lead) are not damaged.	Yes	No
Instrument is firmly grounded to a dedicated grounding terminal.	Yes	No
Fuse is the correct rating.	Yes	No
Protective earth impedance is less than prescribed limit.	Yes	No
Earth leakage current is less than prescribed limits.	Yes	No
Enclosure leakage current is less than prescribed limits.	Yes	No
Patient leakage current is less than prescribed limits.	Yes	No
Withstand voltages of instrument are prescribed voltage and time limits or more.	Yes	No

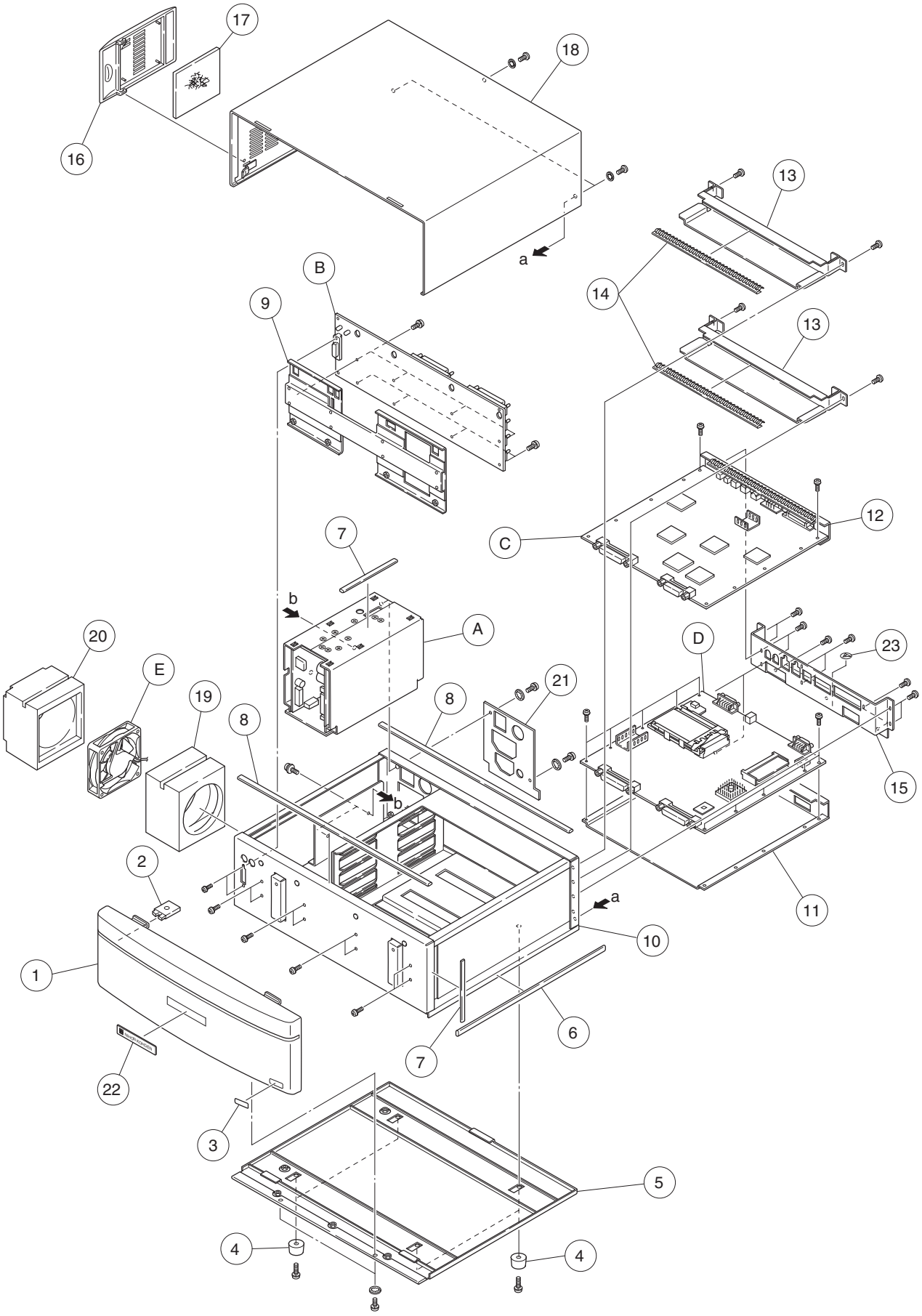
Others

Fan at the side of the main unit works normally.	Yes	No
Line voltage is within the range of nominal voltage ±10%.	Yes	No
Instrument is correctly connected to other equipment.	Yes	No
All screws are tight.	Yes	No

Section 7 Replaceable Parts List

When ordering parts or accessories from your nearest Nihon Kohden Corporation distributor, please quote the NK code number and part name which are listed in this service manual, and the name or model of the unit in which the required part is located. This will help us to promptly attend to your needs. Always use Nihon Kohden parts and accessories to assure maximum performance from your instrument.

Index	NK Code No.	Qty	Description
1	6143-008181	1	Front cover
2	6114-074109A	1	LED filter
3	6124-026696	1	MU-980RA model label
	6124-027935	1	MU-980RJ model label
	6124-027944	1	MU-980RK model label
4	6114-074136B	4	Rubber foot
5	6112-008711A	1	Bottom cover
6	6114-084526	1	Shield sponge rubber 2
7	6114-084535	2	Shield sponge rubber 3
8	6114-084517	2	Shield sponge rubber 1
9	6112-009782A	1	S-MOTHER board retainer
10	6142-000975B	1	Chassis
11	6123-008762D	1	Board holder 1
12	6123-008771E	1	Board holder 2
13	6113-026021B	2	Blank panel
14	6114-084491A	2	Earth spring
15	6113-026012B	1	Socket panel
16	6112-009791B	1	Filter case
17	6114-074199	1	Fan filter
18	6112-008702B	1	Top cover
19	6114-074127B	1	Fan fastening sponge rubber 2
20	6114-074118A	1	Fan fastening sponge rubber 1
21	6123-010144	1	MU-980RA power panel
	6123-009351B	1	MU-980RJ/RK power panel
22	6124-025919	1	Nihon Kohden name plate
23	2229-000798A	1	Attention label
A	SC-030R	1	Power supply unit
B	UR-3349	1	S-MOTHER board
C	UR-33341	1	Main GUI board
D	UR-3350	1	PPC board
E	533718	1	Fan


17
16
18
a
13
14
13
B
9
12
C
7
b
A
D
23
20
E
19
8
21
8
15
b
2
a
11
10
1
6
7
22
3
5
4
4

MU-980R

Section 8 Connector Pin Assignment

Input/Output Connector Pin Assignment 8.1
Color Display Unit, VD-900RA/RK 8.1
HOST Socket 8.1
Color LCD Unit, VL-900PA/VL-910RA 8.2
HOST Socket 8.2
DC IN Socket (VL-900PA only) 8.2
Bedside Station Main Unit, MU-980RA/RJ/RK 8.3
VD/VL Socket, VD/VL 8.3
External RGB Output Socket, RGB 8.3
Alarm Output Socket, ALARM 8.4
Mouse Socket, MOUSE 8.4
Keyboard Socket, KEYB 8.4
General Serial Socket, SERIAL 8.4
Network Socket, NETWORK 8.5
JA Socket 8.5
DC OUT Socket 8.6
Input Box, JA-960PA 8.6
JA Input Socket 8.6
JA Output Socket 8.7
Input Box, JA-980PA 8.7
JA Input Socket 8.7
JA Output Socket 8.8
Multi Parameter Module, AY-900PA 8.8
ECG/BP OUT Socket 8.8
Interface, QI-910RA/RJ/RK 8.9
BSM Socket 8.9
NETWORK 1 Socket 8.9
NETWORK 2 Socket 8.10
HT Input Jack 8.10
Display Connection Box, RY-900P 8.11
HOST Socket 8.11
RGB Output Socket, RGB 8.11
TOUCH PANEL Socket 8.12
DC IN Socket 8.12

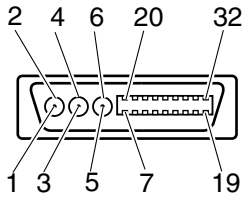
Input/Output Connector Pin Assignment

CAUTION

- **When connecting an external instrument to the output jacks, ensure that the external instrument complies with the IEC60601-1 safety standard for medical equipment or IEC60601-2-27 particular requirements for the safety of electrocardiographic monitoring equipment. When the instrument does not comply with IEC60601-1 or IEC60601-2-27, use a locally available medical use isolation transformer unit between the instrument and the AC outlet.**
- **The monitor should only be connected to an external instrument which complies with the IEC60601-1-2 or CISPR 11 Second Edition 1990-09, Group 1 and Class B standard.**

Color Display Unit, VD-900RA/RK

♦HOST Socket



<Connector>

D sub 32-pin connector Model DX10CJ-26SE-CR3

<Connection Cable>

Display cable S 1.5 m Code no. 529402

Display cable S 5 m Code no. YS-063P0

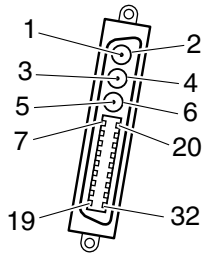
Display cable S 10 m Code no. YS-062P8

<Pin Assignment>

Pin No.	Signal Name	Pin No.	Signal Name
1	ARED	17	DTR (IrDA)
2	E2	18	RTS (IrDA)
3	AGREEN	19	E2
4	E2	20	RXD1 (Touch key)
5	ABLUE	21	TXD1 (Touch key)
6	E2	22	XTRESET (Touch key)
7	HSYNC2	23	E2
8	E2	24	XPWRON
9	VSYNC2	25	XKRESET (I2C)
10	E2	26	XHT
11	SDA (I2C)	27	SOUNDMIX
12	SCL (I2C)	28	ESOUND
13	E2	29	Not used
14	TXD2	30	Not used
15	RXD2	31	Not used
16	CTS (IrDA)	32	Not used

Color LCD Unit, VL-900PA/VL-910RA

♦HOST Socket



<Connector>

D sub 32-pin connector Model DX10CJ-26SE-CR3

<Connection Cable>

Display cable S 1.5 m Code no. 529402

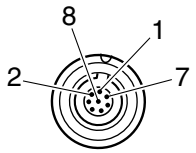
Display cable S 5 m Code no. YS-063P0

Display cable S 10 m cannot be used on the color LCD unit.

<Pin Assignment>

Pin No.	Signal Name	Pin No.	Signal Name
1	ARED	17	DTR (IrDA)
2	E2	18	RTS (IrDA)
3	AGREEN	19	E2
4	E2	20	RXD1 (Touch key)
5	ABLUE	21	TXD1 (Touch key)
6	E2	22	XTRESET (Touch key)
7	HSYNC2	23	E2
8	E2	24	XPWRON
9	VSYNC2	25	XKRESET (I2C)
10	E2	26	XHT
11	SDA (I2C)	27	SOUNDMIX
12	SCL (I2C)	28	ESOUND
13	E2	29	Not used
14	TXD2	30	Not used
15	RXD2	31	Not used
16	CTS (IrDA)	32	Not used

♦DC IN Socket (VL-900PA only)



<Connector>

Model PLG.M0.8GL.LG

<Connection Cable>

DC power cord S 1.5 m Code no. 529394B

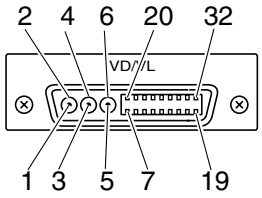
DC power cord S 5 m Code no. YS-063P1

<Pin Assignment>

Pin No.	Signal Name	Pin No.	Signal Name
1	+24VIN	5	SENSE
2	E1	6	Shield
3	+5VBIN	7	Shield
4	E2	8	Shield

Bedside Station Main Unit, MU-980RA/RJ/RK

♦VD/VL Socket, VD/VL



<Connector>

D sub 32-pin connector Model DX10CJ-26SE-CR3

<Connection Cable>

Display cable S 1.5 m Code no. 529402

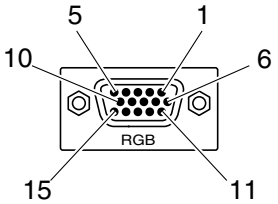
Display cable S 5 m Code no. YS-063P0

Display cable S 10 m Code no. YS-062P8

<Pin Assignment>

Pin No.	Signal Name	Pin No.	Signal Name
1	ARED	17	DTR (IrDA)
2	E2	18	RTS (IrDA)
3	AGREEN	19	E2
4	E2	20	RXD1 (Touch key)
5	ABLUE	21	TXD1 (Touch key)
6	E2	22	XTRESET (Touch key)
7	HSYNC2	23	E2
8	E2	24	XPWRON
9	VSYNC2	25	XKRESET (I2C)
10	E2	26	XHT
11	SDA (I2C)	27	SOUNDMIX
12	SCL (I2C)	28	ESOUND
13	E2	29	Not used
14	TXD2	30	Not used
15	RXD2	31	Not used
16	CTS (IrDA)	32	Not used

♦External RGB Output Socket, RGB



<Connector>

D sub 15-pin connector Model D02-MISSAG-13L9

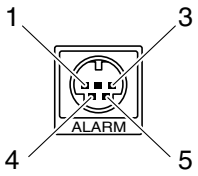
<Connection cable>

RGB cable (10 m) Code no. YS-063P9

<Pin Assignment>

Pin No.	Signal Name	Pin No.	Signal Name
1	RS	9	XCSYNC
2	GS	10	E2
3	BS	11	Not used
4	Not used	12	SDA (I2C) (Cannot be used)
5	E2	13	HSYNC
6	E2	14	VSYNC
7	E2	15	SDL (I2C) (Cannot be used)
8	E2		

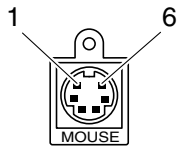
♦Alarm Output Socket, ALARM



<Connector>
Round 6-pin connector Model HR12-10R-5SDL
<Pin Assignment>

Pin No.	Signal Name	Pin No.	Signal Name
1	YLRED	4	+12V
2	YLYELLOW	5	+12V
3	YLGREEN	6	Not used

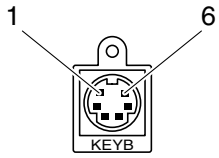
♦Mouse Socket, MOUSE



<Connector>
Round 6-pin connector Model TCS7560-01-201
<Connected Part>
PS/2 specifications mouse
<Pin Assignment>

Pin No.	Signal Name	Pin No.	Signal Name
1	DATAM	4	+5V
2	Not used	5	CLKM
3	E2	6	Not used

♦Keyboard Socket, KEYB



<Connector>
Round 6-pin connector Model TCS7560-01-201
<Connected Part>
PS/2 specifications keyboard
<Pin Assignment>

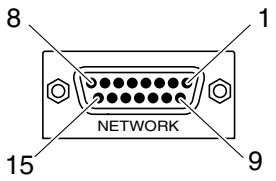
Pin No.	Signal Name	Pin No.	Signal Name
1	DATAK	4	+5V
2	Not used	5	CLKK
3	E2	6	Not used

♦General Serial Socket, SERIAL

<Connector>
D sub 9-pin connector Model RDED-9S-LNA
<Connection Cable>
9P-9P serial cable Code no. YS-061P2
9P-25P serial cable Code no. YS-061P3
<Pin Assignment>

Pin No.	Signal Name	Pin No.	Signal Name
1	CD	6	DSR
2	RXD	7	RTS
3	TXD	8	CTS
4	DTR	9	Not used
5	GND		

♦Network Socket, NETWORK



<Connector>

D sub 15-pin connector Model RDAD-15SE-LNA

<Connection Cable>

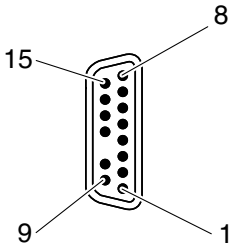
AUI patch cable 1 m Code no. YS-066P3

AUI patch cable 5 m Code no. YS-063P6

<Pin Assignment>

Pin No.	Signal Name	Pin No.	Signal Name
1	E2	9	COL–
2	COL+	10	TX–
3	TX+	11	Not used
4	Not used	12	RX–
5	RX+	13	+12V
6	+12GND	14	Not used
7	Not used	15	Not used
8	Not used		

♦JA Socket



<Connectors>

Washer female 15-pin straight Model JAY-15S-2A3G13-N

Stopper male Model JAZ-15P (11)-13

<Connecting Cables>

JA connection cable Code no. YJ-900P (0.4 m)

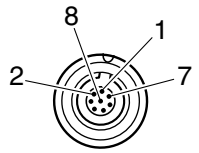
JA connection cable Code no. YJ-901P (2.5 m)

JA connection cable Code no. YJ-902P (5.0 m)

<Pin Assignment>

Pin No.	Signal Name	Pin No.	Signal Name
1	+24VOUT	9	Not used
2	E2	10	CNNTIN
3	RXIN+	11	Not used
4	RXIN–	12	Not used
5	TXOUT+	13	Not used
6	TXOUT–	14	Not used
7	CTLOUT+	15	Not used
8	CTLOUT–		

♦DC OUT Socket



<Connector>

Model PLG.M0.8GL.LG

<Connection Cable>

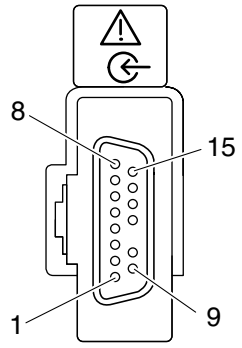
DC power cord S 1.5 m Code no. 529394A

<Pin Assignment>

Pin No.	Signal Name	Pin No.	Signal Name
1	+24VOUT	5	SENSE
2	E1	6	Shield
3	+5VBOUT	7	Shield
4	E2	8	Shield

Input Box, JA-960PA

♦JA Input Socket



<Connectors>

Washer male 15-pin straight Model JAS-15P-2A3G13-N

D sub 15-pin connector

<Connection Cables>

JA connection cable Code no. YJ-900P (0.4 m)

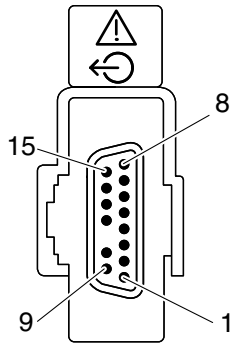
JA connection cable Code no. YJ-901P (2.5 m)

JA connection cable Code no. YJ-902P (5.0 m)

<Pin Assignment>

Pin No.	Signal Name	Pin No.	Signal Name
1	+24VIN	9	Not used
2	E2	10	CNNTOUT
3	RXOUT+	11	Not used
4	RXOUT–	12	Not used
5	TXIN+	13	Not used
6	TXIN–	14	Not used
7	CTLIN+	15	Not used
8	CTLIN–		

♦JA Output Socket



<Connectors>

Washer male 15-pin straight Model JAS-15S-2A3G13-N

D sub 15-pin connector

<Connection Cables>

JA connection cable Code no. YJ-900P (0.4 m)

JA connection cable Code no. YJ-901P (2.5 m)

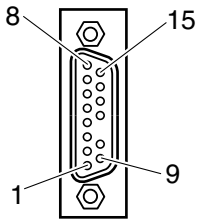
JA connection cable Code no. YJ-902P (5.0 m)

<Pin Assignment>

Pin No.	Signal Name	Pin No.	Signal Name
1	+24VOUT	9	Not used
2	E2	10	CNNTIN
3	RXIN+	11	Not used
4	RXIN–	12	Not used
5	TXOUT+	13	Not used
6	TXOUT–	14	Not used
7	CTLOUT+	15	Not used
8	CTLOUT–		

Input Box, JA-980PA

♦JA Input Socket



<Connectors>

Washer male 15-pin right angle Model JAY-15P-1A2G13-N

D sub 15-pin connector

<Connection Cables>

JA connection cable Code no. YJ-900P (0.4 m)

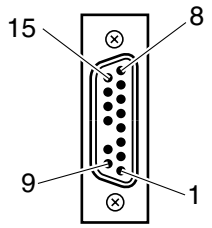
JA connection cable Code no. YJ-901P (2.5 m)

JA connection cable Code no. YJ-902P (5.0 m)

<Pin Assignment>

Pin No.	Signal Name	Pin No.	Signal Name
1	+24VIN	9	Not used
2	E2	10	CNNTOUT
3	RXOUT+	11	Not used
4	RXOUT–	12	Not used
5	TXIN+	13	Not used
6	TXIN–	14	Not used
7	CTLIN+	15	Not used
8	CTLIN–		

♦JA Output Socket



<Connectors>

Washer male 15-pin right angle Model JAY-15S-1A2G13-N

D sub 15-pin connector

<Connection Cables>

JA connection cable Code no. YJ-900P (0.4 m)

JA connection cable Code no. YJ-901P (2.5 m)

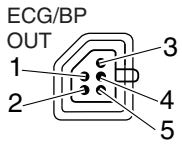
JA connection cable Code no. YJ-902P (5.0 m)

<Pin Assignment>

Pin No.	Signal Name	Pin No.	Signal Name
1	+24VOUT	9	Not used
2	E2	10	CNNTIN
3	RXIN+	11	Not used
4	RXIN–	12	Not used
5	TXOUT+	13	Not used
6	TXOUT–	14	Not used
7	CTLOUT+	15	Not used
8	CTLOUT–		

Multi Parameter Module, AY-900PA

♦ECG/BP OUT Socket



<Connection Cable>

ECG/BP output cable (5 m) Model YJ-910P

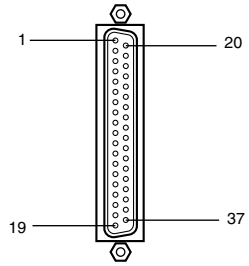
ECG/BP output cable (0.3 m) Model YJ-920P

<Pin Assignment>

Pin No.	Signal Name	Cable Color
1	GND	Black
2	SHIELD	Steel white
3	BPOUT	Green
4	HTOUT	Red
5	ECGOUT	White

Interface, QI-910RA/RJ/RK

♦BSM Socket



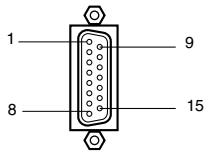
<Connector>

D sub 37-pin connector Model 17LE-13370-27D4AK

<Pin Assignment>

Pin No.	Signal Name	Pin No.	Signal Name
1	SD	20	Not used
2	SD RET	21	MODE 0
3	Not used	22	XAE
4	XBUSY	23	XAL
5	XBUSY RET	24	MODE 1
6	IBW	25	E2
7	RD	26	E2
8	RD RET	27	MDW
9	Not used	28	ECG1W
10	Not used	29	CH7W/RW
11	Not used	30	CH3W/P1W
12	Not used	31	CH4W/P2W
13	ECG2W	32	CH5W/P3W
14	Not used	33	E1
15	XHO	34	E1
16	CH6W/P4W	35	Not used
17	CH8W/EXTAUX	37	Not used
18	E2		Not used
19	Not used		

♦NETWORK 1 Socket



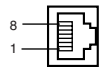
<Connector>

D sub 15-pin connector Model RDAD-15S-LNA, hexagonal (2.6 mm)

<Pin Assignment>

Pin No.	Signal Name	Pin No.	Signal Name
1	GND	9	COL−
2	COL+	10	A_TX−
3	A_TX+	11	GND
4	GND	12	A_RX−
5	A_RX+	13	+12V
6	+12VGND	14	GND
7	Not used	15	Not used
8	GND		

♦NETWORK 2 Socket



<Connector>

Module jack Model 555141-1

<Pin Assignment>

Pin No.	Signal Name	Pin No.	Signal Name
1	TX+	5	Not used
2	TX–	6	RX–
3	RX+	7	Not used
4	Not used	8	Not used

♦HT Input Jack

<Connector>

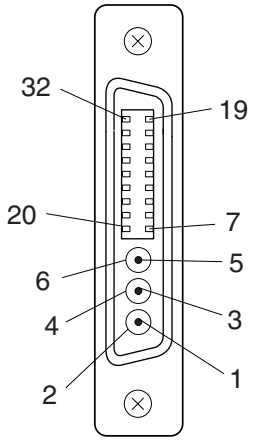
Pin jack Model HLJ0521-01-1010

<Pin Assignment>

Pin No.	Signal Name
1	Shield
2	E2
3	XHT

Display Connection Box, RY-900P

♦HOST Socket



<Connector>

D sub 32-pin connector Model DX10CJ-26SE-CR3

<Connection Cable>

Display cable S 1.5 m Code no. 529402

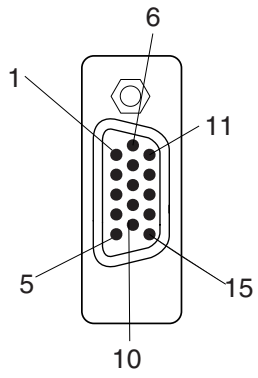
Display cable S 5 m Code no. YS-063P0

Display cable S 10 m Code no. YS-062P8

<Pin Assignment>

Pin No.	Signal Name	Pin No.	Signal Name
1	ARED	17	DTR (IrDA)
2	E2	18	RTS (IrDA)
3	AGREEN	19	E2
4	E2	20	RXD1 (Touch key)
5	ABLUE	21	TXD1 (Touch key)
6	E2	22	XTRESET (Touch key)
7	HSYNC2	23	E2
8	E2	24	XPWRON
9	VSYNC2	25	XKRESET (I2C)
10	E2	26	XHT
11	SDA (I2C)	27	SOUNDMIX
12	SCL (I2C)	28	ESOUND
13	E2	29	Not used
14	TXD2	30	Not used
15	RXD2	31	Not used
16	CTS (IrDA)	32	Not used

♦RGB Output Socket, RGB



<Connector>

D sub 15-pin connector Model D02-MISSAG-13L9

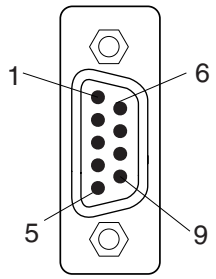
<Connection cable>

RGB cable (1.0 m) Code no. 577689

<Pin Assignment>

Pin No.	Signal Name	Pin No.	Signal Name
1	RS	9	Not used
2	GS	10	E2
3	BS	11	Not used
4	Not used	12	Not used
5	E2	13	HSYNC
6	E2	14	VSYNC
7	E2	15	Not used
8	E2		

♦TOUCH PANEL Socket



<Connector>

D sub 9-pin connector Model RDED-9S-LNA

<Connection Cable>

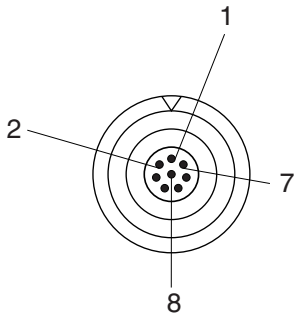
9P-9P serial cable Code no. YS-061P2

9P-25P serial cable Code no. YS-061P3

<Pin Assignment>

Pin No.	Signal Name	Pin No.	Signal Name
1	CD	6	DSR
2	RXD	7	RTS
3	TXD	8	CTS
4	DTR	9	Not used
5	GND		

♦DC IN Socket



<Connector>

Model PLG.M0.8GL.LG

<Connection Cable>

DC power cord S 1.5 m Code no. 529394A

<Pin Assignment>

Pin No.	Signal Name	Pin No.	Signal Name
1	+24VIN	5	SENSE
2	E1	6	Shield
3	+5VBIN	7	Shield
4	E2	8	Shield